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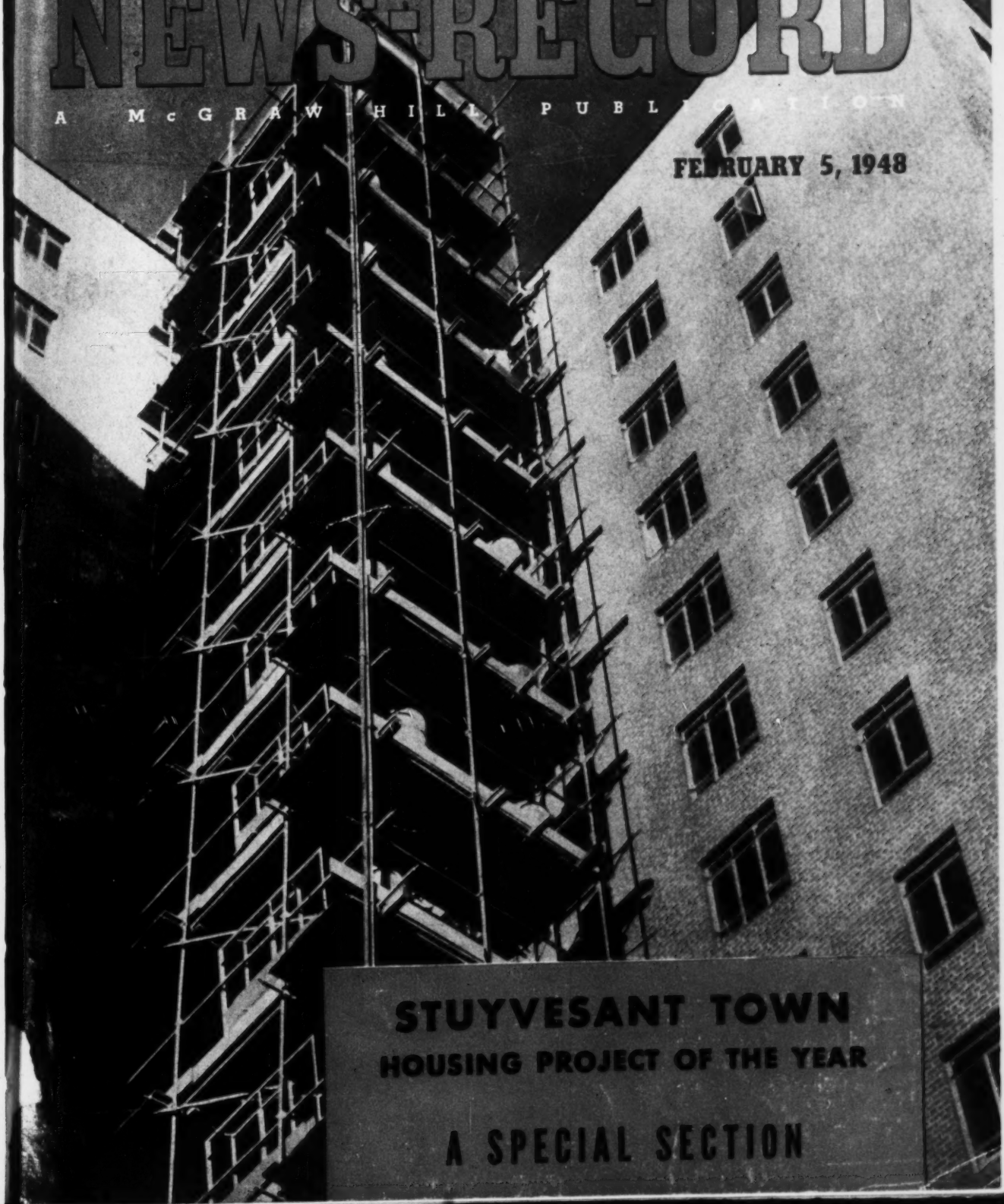
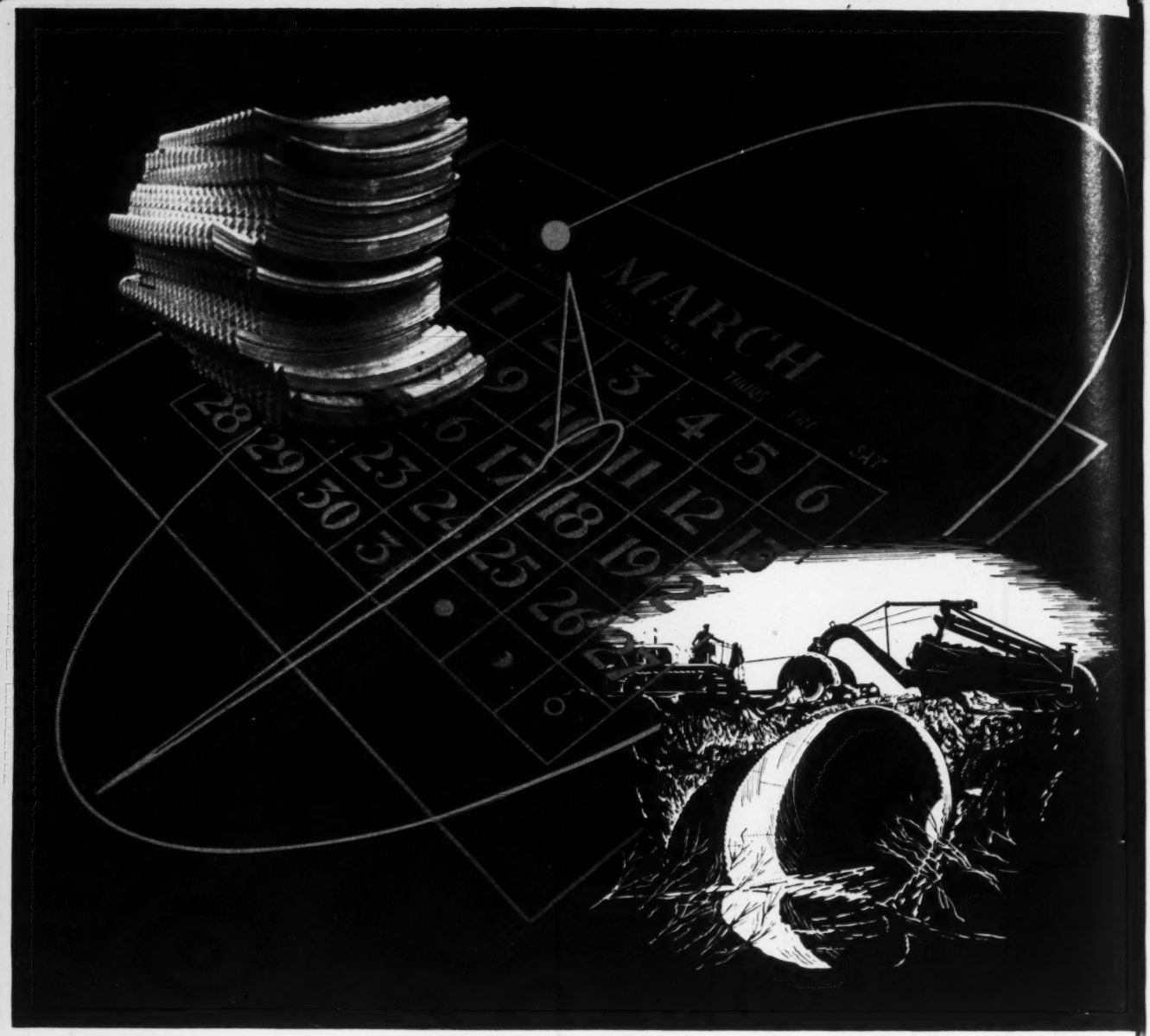


STUYVESANT TOWN
HOUSING PROJECT OF THE YEAR

A SPECIAL SECTION



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ENGINEERING NEWS-RECORD

Volume 140 • Number 6

February 5, 1948

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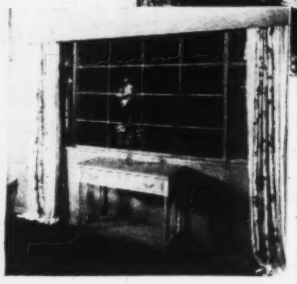
47,354 Truscon Steel Casements for Stuyvesant Town Apartments

A big dent in the New York City housing shortage situation is being made as unit after unit of the new Stuyvesant Town Apartments is being completed. The entire project will cover 75 acres, with 35 separate buildings containing 8,759 modern apartments.

In every room of each of these many apartments, Truscon Steel Casement Windows will bring the occupants ample supplies of nature's free sunlight and fresh air. The beautiful design of the windows themselves helped achieve outstanding architectural distinction in the structures, both for the exteriors and interiors.



Truscon Steel Casements, due to their individuality and flexibility of arrangement, meet the particular requirements of every type of room. Where windows are opened and closed frequently, or where ventilation needs are great and varied, Truscon Steel Casements fill a definite utilitarian need in addition to being highly decorative. Clean, bright, air-controlled kitchens are possible. The side-hinged casements can be adjusted by fingertip touch to invite or retard the flow of air, to suit the range of requirements in each room.

Truscon heavy steel construction, corner-welding of ventilators and frames, projection-welding of hinges and sturdy hardware assure the home-owner a long-time, trouble-free investment in windows with an economy of maintenance. There is no sagging, binding or warping in Truscon Steel Casements. Perfect fit and uniform contact give complete protection against inclement weather. Truscon's Bonderizing of all steel surfaces and the baked-on prime coat provide an excellent surface for finish coats of paint, and assure maximum protection against corrosion.

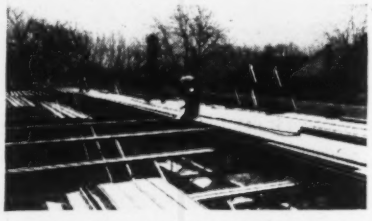
Truscon Casement Screens and Storm Sash are available for quick, convenient installation. Write for free descriptive catalog showing complete range of Truscon Steel Casement types and sizes.

Stuyvesant Town Apartments, New York City, a Development of the Metropolitan Life Insurance Company

Roof Jobs Made Easy

Specify Truscon "Ferrobord" Steeldeck to get the quick, economical, permanent answer to any roof problem you may have.

"Ferrobord" Steeldeck consists of a parallel system of strong structural interlocking steel members which present a smooth surface over which can be applied built-up roofing of any type, with or without insulation. "Ferrobord" is made from 18-gauge copper-bearing strip steel, having an ultimate strength of not less than 50,000 lbs. per square inch. Each unit is 6 inches wide and has a depth of either 1½ or 1¾ inches.



Application of "Ferrobord" Steeldeck

With these specifications you can design a roof job that's got strength and effective area coverage at reasonable cost. The Truscon Steel Company will be glad to cooperate with local roof companies in selecting the proper type of insulation and built-up roofing to meet certain definite requirements of structures. Write for free catalog.

Concrete Reinforcing Bars Proved Worth in 1906

An interesting fact is that the San Francisco earthquake disaster in 1906 served as a proving ground for Truscon's Reinforcing Bars. Among the buildings which did not crack or crumble from the quake were those constructed of concrete utilizing Truscon Bars.

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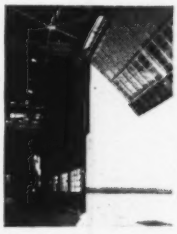
Truscon Steel Hangar Doors are the product of 20 years of manufacturing experience and research combined with the best engineering skill, workmanship and materials. Their design, manufacture and erection is a highly developed art and must be undertaken by experienced men, in order to attain completely satisfactory installations.

The success of a hangar door installation depends to a great extent on the experience and good judgment of the manufacturer's field organization. Truscon's field crews are comprised of specially trained men who "know how" through years of experience with many installations, to do just the right things to make the job a success.



Truscon designs and manufactures Straight Slide Doors; Tail Doors; Braced, Unbraced and Bifold Doors; Vertical Lift Canopy Doors and Three-Section Vertical Lift Type Doors. Write for free descriptive literature.

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A new 8-page folder on light Industrial Steel Doors, Series 31. Complete with construction and installation details, specifications, sizes and types. Write for your free copy today.

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News of the Week

ENGINEERING NEWS-RECORD • FEBRUARY 5, 1948 • VOLUME 140 • NUMBER 6

Road group, federal leaders differ on industry capacity

Government agency heads believe highway program nears optimum rate, ARBA calls for further increase in tempo—J. T. Callaway reelected president

A clear-cut difference of opinion as to how much "road" the roadbuilding section of the construction industry can actually produce developed as a central theme of the 45th annual meeting of the American Roadbuilders Association, at Washington, D. C. last week.

The meeting also took up the questions of means to reduce construction costs, expediting of urban and secondary highway programs, the national airport program, and technological developments. J. T. Callaway of Chicago was re-elected president of organization.

The roadbuilders themselves—their optimism bolstered by reports of continued easing of the materials supply situation, increases in labor productivity and probable early loosening of the tight equipment situation—displayed confidence in their ability to step up the tempo of street and highway construction. Their confidence was reflected in a resolution adopted near the end of the three-day meeting, favoring a continuation of the present federal highway program, but at an accelerated rate based on $800,000,000 of federal funds annually.

Congressional leaders, complimenting the industry on its construction records of the last year, gave assurance that ample federal funds would be forthcoming to insure continuation of large construction programs.

PRA head takes opposing view

But an opposite view of the present and potential highway program was taken by Thomas H. MacDonald, Public Roads Administration commissioner, who said that records of his agency show that "for the country as a whole, highway work is being offered to the construction industry at a rate exceeding that which (the industry) can absorb it."

Mr. MacDonald said unsatisfactory progress was reported on 27 percent of active federal-aid projects in the last quarter of 1947, delays being attributed to the following factors: Poor management, 31 percent; shortage of materials and equipment, 18 percent each; shortage of labor and labor problems, 15 percent; weather and miscellaneous causes, 18 percent.

"Chief among the causes of poor management were failure both to start the work on time and to expedite it properly," declared MacDonald, "although postponing the start of one project in the interest of completing another, in many cases may be considered good management by the contractor.

"Another reason for unsatisfactory progress is the fact that too many contractors have been awarded more work than they can handle with their present equipment and organization." In this connection, powered construction equipment and the rate at which its use is expanded on highway work is viewed by the PRA head as the most important single factor in the highway program.

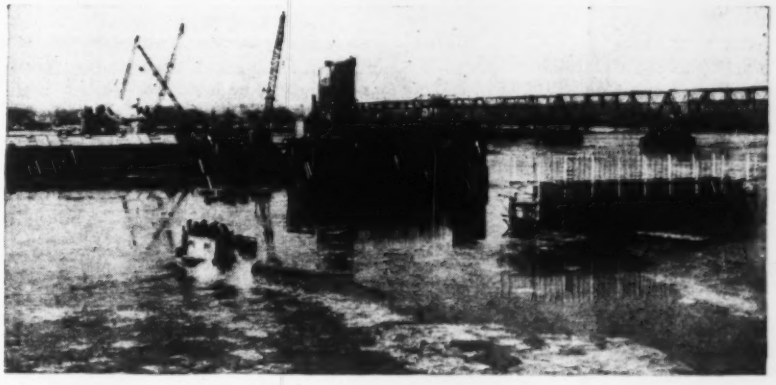
Optimum rate may be reached

Commissioner MacDonald said the unsatisfactory progress reported on so many projects now under construction —together with the limited competition among contractors for new work, evidenced by lack of bids at contract lettings—strongly indicates that the U. S. has reached the optimum rate of contract awards in relation to construction capacity.

"To exceed this rate will not result in the faster completion of the work," he said, " but it will promote lack of competition, unsatisfactory progress and unnecessarily high prices."

Similar views on the contractors' capacity to increase the total volume of highway construction also were ex-

(*Continued on page 56*)



***Twin Bridges for Capital**—Despite some ice in the Potomac River, work is well advanced on the first of two highway bridges being built at the foot of 14th St., Washington, D. C. Each crossing will consist of a series of continuous plate-girder units, with most spans 165 ft., plus a 105-ft. double-leaf bascule span at the main channel. When the first of the new bridges is complete, the inadequate steel-frame bridge in the background will be torn down and the second bridge will be built there. Built under the supervision of the District of Columbia Highway Department and the Public Roads Administration, the new structure will cost about $7,000,000. Merritt, Chapman & Scott, of New York, are contractors on foundations.*

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Public Construction—A bill to give each of the 120 counties in *Kentucky* $100,000 to construct county buildings has been introduced in the legislature. . . . The Sisters of Our Lady of Charity of the Good Shepherd, *Philadelphia Pa.*, will build a group of buildings in the northeastern section of the city to cost about $2,500,000 . . . *Hamilton Township, N. J.*, will build a $2,000,000 junior high school . . . Illinois State Fair, at *Springfield* in April will seek bids on two new buildings to cost about $3,250,000 . . . The Nova Scotia Liquor Commission will erect a $1,000,000 provincial headquarters at *Halifax* . . . Bids are being received for a $1,000,000 library at the University of Alberta at *Edmonton* . . . Work is to start soon on passenger sheds on docks at *West St. Johns, N. B.*, to cost $1,100,000 and also for a wharf and transit shed on the east side of St. Johns harbor to be built at a cost of about $2,500,000.

Industrial Construction—Contracts totalling $3,119,698 were let Jan. 15 for the state office building at *Jackson, Miss.* . . . Delaware Power and Light Co. power plant at *Wilmington* will cost $13,000,000 . . . Supplee-Wills-Jones Milk Co., *Philadelphia, Pa.*, plans to spend $5,500,000 in expansion projects in the next three years . . . Walter Kidde Constructors will build the Chicago Pneumatic Co's $3,000,000 plant at *Utica, N. Y.* . . . Wrench Suburban Hotel Chain will build a $2,000,000 hotel at *Waco, Tex.* . . . The Canadian National Railways plans a $4,000,000 International Aviation Building at *Montreal* . . . The First National Bank, of *Rochester, Minn.*, will build a $1,000,000 building.

Highways—*Boston, Mass.*, is considering construction of a one-mile six-lane express highway between Sumner Tunnel and McClellan Highway . . . the Delaware River Joint Toll Bridge Commission has plans for a $2,000,000 bridge between *Trenton, N. J.*, and *Morristville, Pa.* . . . J. Paul Ambler, district engineer, says 1.74 miles of the Penn-Lincoln Parkway near *Pittsburgh, Pa.* will be opened to limited inbound traffic by July 1 . . . *Allegheny Co., Pa.*, hopes to advertise shortly for bids for main superstructure of the new Rankin and Dravosburg bridges.

Housing—St. Vincent Homes, Inc., *Philadelphia, Pa.*, is erecting a $2,000,000 development . . . If Ontario makes land available, the Canadian government will build 4,000 low-rental houses in the *Toronto* district . . . Bell-Tex Corp. is planning a $2,000,000 project of 130 homes in Bellaire at *Houston, Tex.* and R. C. Heinn in the same city will build a $1,400,000 project of 140 homes. Other Houston developments are a $3,000,000 home program by Frank W. Sharp and a $2,500,000 development by Archer Homes, Inc. . . . The housing authority of *Boston, Mass.*, has awarded a contract to Construction Units, Inc., for 25 two-family houses at an average price of $18,000.

Sewers and Water Supply—*Seaside Park, N. J.*, has let a $263,000 contract for a water and sewage treatment plant . . . Plans are being prepared for a $250,000 reservoir to supply a million gallons of water, for *Stroud, Okla.* . . . *Lewes, Del.*, has announced plans completed for a $296,000 sewage system. . . . Plans by Freese, Nichols and Turner, Houston, Tex., consulting engineers, for a $3,000,000 city utility improvement program, consisting of an increased water supply and a new power plant, have been approved by the city commissioners of *Bryan, Tex.* . . . Eight major projects are planned for the sanitary sewer system of *Jacksonville, Fla.*, if the $10,000,000 bond issue is approved at the April 6 referendum.

Indians' McNary case to be heard in April

The lawsuits by which two Indian tribes seek to block construction of McNary Dam on the Columbia River probably will be heard in April, federal court attaches said after Judge Sam S. Driver in federal district court at Spokane, Wash., denied a government motion to dismiss the action.

Federal attorneys did not question the Indians' rights to claim damages if salmon runs in the river were impaired but based their motion on the ground that the Court of Claims, rather than a court of equity, was the proper place for a hearing of the matter.

Judge Driver cited fishing rights as having a "peculiar and special value to the Indians" and noted that these rights were irreplacable.

Filed by the Yakima and Nez Perce Indians, the suits allege construction of the dam will infringe property rights guaranteed to the Indians by a 93-year old treaty. They ask an injunction to prohibit the Guy F. Atkinson Co., which is building the dam for the government, from carrying out further construction.

State court restricts use of word "engineering"

A corporation or company may not use the words "engineer," "engineering," "surveyor" or "surveying" in its corporate or company name in advertising, nor may such a firm legally practice or offer to practice engineering or land surveying in Washington state, Attorney General Smith Troy has ruled at Olympia, Wash.

"Professional engineering is of such a personal nature that it can not be practiced by a corporation or company," Troy said in his opinion.

State officials interpreted the ruling to mean that the name "John Doe Engineering Co." would be acceptable, but "XYZ Engineering Co." would not.

Troy based his ruling on language of the Engineers' Registration Act passed by the last legislature, which provides that certain qualifications acquired by a natural person cannot be possessed by a corporation or a company.

1947 house-building up 27 percent over 1946

Housing starts slumped to a seasonal low point in December when construction was begun on 62,000 new nonfarm dwelling units, according to a preliminary estimate of the Bureau of Labor Statistics, U. S. Department of Labor. Severe winter weather in many areas was partly responsible for a drop of 18,000 units (23 percent) from the revised estimate of 80,000 for November. Nevertheless, the number of dwelling units begun in December exceeded by 22,700 (58 percent) the number started in December, 1946.

The brisk rate of housebuilding in the summer and autumn months resulted in a total of 854,600 new permanent units being put under construction during 1947, which surpassed the 1946 achievement by 27 percent, the best homebuilding year since 1925 when 937,000 units were started.

Housing completions rose steadily during 1947 as the time required to make a new house ready for occupancy decreased to about 4½ months.

Miss. Valley Association opposes MVA-type plans

Unqualified opposition to any form of Missouri Valley Authority-type plan for river valley development was expressed by the Mississippi Valley Association in a resolution adopted at a closing session of its annual convention at St. Louis, Mo., Jan. 27.

Ready-mixed concrete improvements discussed by producers and suppliers

National Ready Mixed Concrete Association and National Sand and Gravel Association see more business ahead in 1948

Improvement of product and supplying concrete materials to meet construction demands were high points of a 5-day meeting in Cincinnati, Ohio, when the National Ready Mixed Concrete Association held its 18th annual meeting concurrently with the 32nd annual convention of the National Sand and Gravel Association. Attendance records were broken, with a total registration of 1,194. This meeting also marked the resumption of an equipment exhibit, after a 6-year hiatus.

Despite the fact that the NSGA has enjoyed less percentage price rise for the sale of sand and gravel than any other important industry in this country, profits have been maintained, declared R. N. Coolidge, 1947 president of the association. This has been accomplished through increased volume, good management and improved methods of production. Wages, income, consumer spending and construction costs are still in a rising trend, said he, and they will not come down until demand is satisfied. He predicted that 1948 will be another boom year, constructionwise, although general price levels appear about ready to stabilize at existing or slightly higher levels.

During 1947, production of sand and gravel in this country totaled 215,000,000 tons, declared Mr. Coolidge, representing an increase between 10 and 15 percent over the previous year.

Ready-mixed concrete in Ohio

Suggestions for improving ready-mixed concrete in highway and bridge construction were presented by J. F. Barbee, engineer of concrete tests, Ohio Department of Highways, who reported that 48,000 cu. yd. of ready-mixed concrete was used in bridge construction on the Ohio state highway system last year. About 5 percent of the concrete pavement laid last year, also was ready-mixed concrete.

Ready-mixed concrete lends itself more readily to pavement patching and bridges involving small yardages than to large paving projects, said Mr. Barbee. But in either case prolonged mixing on long hauls reduces the air-content in air-entrained concrete. This has been avoided on some jobs by charging the transit mixer with the aggregates and cement at the batching plant, but not starting mixing operations until the truck is within 15 min. of arrival at the site of the job.

Another problem encountered in concrete highway paving in Ohio is the segregation of mortar and aggregates through the improper use of pouring spout on the mixer trucks. Most effective method of avoiding this segregation is to side-dump directly ahead of a spreader, operating on the road forms.

Open forum

Loss of air in air-entrained ready-mixed concrete while in transit was the subject of considerable discussion during an open forum on problems of ready-mixed concrete production. No general agreement was reached on how much entrained air is lost for any specific length of haul or mix of concrete.

One delegate from Detroit reported that on a recent job in that city there was no discernible loss of entrained air in a 5-in. slump concrete containing 5 percent air at the mixer and hauled 5 mi. to the job. Another delegate said he kept his loss of entrained air under 1½ percent of total concrete volume by limiting the speed of drum to 2 rpm. during transit.

General dissatisfaction was expressed in the forum regarding the poor quality of service being rendered by commercial testing laboratories in making compressive strength tests on ready-mixed concrete cylinders. Consensus of the group was that greater care should be given the test specimen from the time it is made until it is broken in the laboratory.

Reporting on the outlook for the supply of cement during 1948, Vincent F. Ahearn, executive-secretary of both organizations, declared that a recent survey of 52 representative cement companies indicates a 10-percent increase this year over 1947. Cement production in 1947 totaled 184,000,000 bbl., three-percent of which was exported.

Railroad car supply in the cement industry continues to be a real problem. At present, the railroad companies have a total of only 14,043 covered hopper cars for bulk cement, although 3,762 are now on order.

In reviewing the development of the ready-mixed concrete industry since it was first conceived 32 years ago, Stanton Walker, director of engineering for both the NSGA and NRMCA, reported that today all but four of the state highway departments make some provisions for the use of ready-mixed concrete in highway construction. State specifications vary widely, however, with maximum allowable hauling time running from 30 min. to 1½ hr.

New officers

New officers elected by the National Ready Mixed Concrete Association were C. Gray, Ready Mixed Concrete Corp., Indianapolis, Ind., president; Robert F. Porter, Harry T. Campbell Sons' Corp., Towson, Md., vice-president; and William Moore, J. P. O'Connell Co., Boston, Mass., secretary-treasurer.

Newly elected officers of the National Sand and Gravel Association are: T. E. Popplewell, Fort Worth Sand and Gravel Co., Ft. Worth, Tex., president, succeeding Frank R. Spratlen, Jr., Ready Mixed Concrete Co., Denver, Colo.; H. N. Snyder, Buffalo Slag Co., Buffalo, N. Y., vice-president; and A. R. Shiely Co., St. Paul, Minn., secretary-treasurer.

Hawaii to expend $17 million on works

Hawaii's territorial public works department will spend $17,178,150 on public works and improvements this year, Superintendent Robert M. Belt has announced.

The figure is five times what was spent in 1947 and represents principally improvements authorized by the 1947 Hawaii legislature.

In all, $8,804,150 is allotted for highways, $6,714,000 for general public works including principally new public buildings, and $1,660,000 for airports.

The territorial program does not include an extensive sewer program being undertaken by the city-county of Honolulu and about to be advertised for mainland bids.

Arizona makes new move in Colorado River matter

The formation of an interstate stream commission to act as a strategy board on Colorado River matters, and an appropriation of $175,000 to finance its operation for the next year and a half have been voted by the third special session of the 18th Arizona legislature, specifically called by Gov. Sidney P. Osborn to discuss the bill. The measure creates a 7-man commission to serve 6-year terms, with jurisdiction in interstate stream matters.

Immediately upon adjournment of the session, Governor Osborn reconvened the legislature for a fourth special session to consider establishment of a ground water code to regulate pumping.

Differ on road construction capacity

(*Continued on page 53*)

pressed by Maj. Philip B. Fleming, administrater, Federal Works Agency. The large volumes of work undertaken last year but now being carried over into the coming construction season, he told the group, indicates that the rate of contract lettings in some states is exceeding the ability of contractor forces to carry out the program.

Admitting that a complete overhauling of our highways is long overdue, General Fleming cautioned against offering work to bidders in such large quantity as to create unreasonable demands for men, materials and equipment.

Effects of the Marshall plan

No serious problems for the American road machinery manufacturing industry, due to the Marshall plan for European recovery, are visualized by George L. Bell, associate director, Office of International Trade. Crawler tractors, motorized road graders and certain sizes of diesel engines are still in critically short supply, he said, but production of other type tractors, equipment accessories and replacement parts is sufficient to meet any reasonable export demands of the European Recovery Program.

Mechanization of European agriculture should not require as many heavy crawler tractors as indicated, and there still is a large inventory of this equipment, as well as motorized road graders, in our Army surplus stock abroad, he added.

Discussing the impact of roadbuilding equipment shortages on domestic construction, Mr. Bell warned that during the first year of its operation demands of the European Recovery Program for certain items of construction equipment may retard U. S. highway and airport programs. But in such an eventuality, and even with the prospects of continued shortages of certain steel products, Mr. Bell saw no need for elaborate control of the construction equipment industry to meet export requirements.

Priority of awards

Continuing its policy of securing sound highway construction on as economical a basis as consistent with rising prices, PRA has adopted three general prerequisites for determining priority of awarding contracts, according to A. C. Clark, chief of PRA's Division of Construction.

They are: (1) the proposed improvement must be urgent in character to avoid subsequent elimination of important work because of overruns in cost of routine projects; (2) there must be adequate competition among bidders to assure the most favorable bids; and (3) the reasonableness of bid prices must be justified with realistic engineering estimates based on an adequate analysis of all factors affecting the work.

Other corrective steps being taken to prevent an undue upsurge in construction costs—currently running 15 percent above 1946 prices—include adoption of more short-term contracts to reduce gambling on unpredictable wage and price rises. Obscure and indefinite specification provisions are being eliminated, unnecessary hand work is being eliminated on construction, while construction specifications are being made more flexible to permit greater utilization of improved types of equipment, Mr. Clark said.

Funds for local work

The plan of the Public Roads Administration to deal only with the state highway departments in using federal aid funds, rather than working a with local government groups, met wi the approval of Otto S. Hess, engine manager of the Kent County, Mi Road Commission. Addressing the te nical division, he urged that the stat in working with counties and citi allow local groups to do as much d tailed planning and supervision of co struction as possible. This procedur he said, would permit the local bodi to build up much-needed, stronger eng neering staffs.

R. B. Traver, engineer of Onondag County, N. Y., saw great promise in th use of short-wave radio equipment o construction and maintenance. In mak ing use of the six wave bands the fed eral agencies have made available fo this purpose, the highway groups should own and operate their own facilities rather than attempt to secure this serv ice from commercial organizations, he recommended.

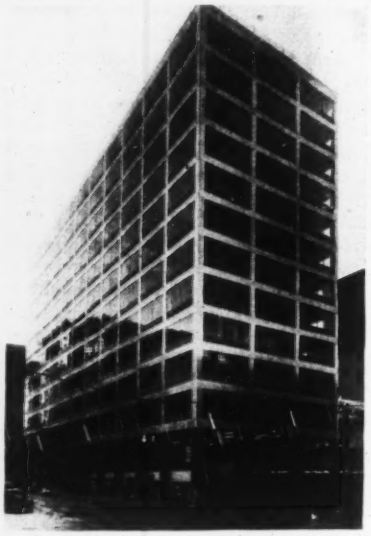
Many seldom-used railroad grade crossings could be closed and thus the country's highways made much safer. Robert B. Brooks, St. Louis consulting engineer, stated in a progress report on the work of the special committee studying this problem. He recommended that each state initiate a survey of all grade crossings—a study which would show that many crossings now used so infrequently as to be traffic hazards could be permanently closed.

A special bulletin on design of rigid-type pavements has been prepared by the division of concrete design and has just been published by the ARBA. E. W. Bauman of the National Slag Association reported. Designated technical bulletin 121, 1947, the report may be obtained from the Washington offices of the ARBA.

Airport program moves forward

The billion-dollar civilian federal-aid airport program is rapidly moving forward and 158 project applications calling for a total of nearly $15,000,000 of federal assistance and requiring slightly over this amount in matching funds have already been approved, Paul Morris, director of airport operations services for the Civil Aeronautics Administration told the airport division. Construction contracts have been awarded for 78 of these projects and 17 jobs are being built by force-account, Mr. Morris stated. Of the approved projects, 43 are Class 1 (small fields), 49 for work on Class 2 fields, 56 at Class 3 fields, and only 10 at Class 4 and larger fields.

Of the 900 projects included in the 1948-49 national airport plan, 746 sponsors have revealed that work will definitely go ahead, including 75 jobs for which architect-engineer contracts have



Optical Illusion—The new 12-story home office building for the Equitable Savings & Loan Association at Portland, Ore., appears to be transparent, as large areas of glass reflect the surrounding structures. Just completed at a cost of $2,500,000, the structure is of reinforced concrete with no steel frame, windows are fixed, and the building is air conditioned throughout. Use of perlite instead of sand in the plaster is said to have reduced the weight of the building by about 1200 tons. Russ B. Hammond of Portland was contractor, and Pietro Belluschi was architect.

been awarded and 470 projects for which the field surveys have completed, Mr. Morris said. Some 419 of the projects have been approved as part of the master plan, detailed plans and specifications have been approved for 207 jobs, work on plans and specifications for 414 other projects is underway.

Federal funds for the huge airport program are being supplied from $45,000,000 Congress appropriated for the fiscal year 1947 and $32,500,000 for the present fiscal year (*ENR* Jan. 8, vol. p. 23). To further advance the work, President Truman in his annual budget message asked for over $67,000,000, including $40,000,000 for grants to local groups and $23,000,000 for building air navigation facilities (*ENR* Jan. 15, vol. p. 77).

Best specifications discussed

Whether specifications now used by the state highway departments should be for airport work in those states received much discussion at the sessions of the airport division. Many speakers were in favor of preparation of entirely new specifications, while others said that most of the construction would be done by contractors building highways in those areas and thus there would be the advantage that these firms would be well acquainted with the requirements on highway work. Others believed that special regional specifications should be prepared. Almost all speakers agreed that no attempt should be made to use a national set of specifications, as this would prevent maximum use of local materials and construction methods.

Highway and expressway construction in urban areas, while receiving considerable impetus under the 1944 Federal-Aid Highway Act, is still far from keeping pace with traffic demands. This is indicated in a report presented by Joseph Barnett, chief, Urban Road Division, PRA, giving the current status of the three-year, $750,000,000 federal-aid urban highway program to be as follows: $410,000,000 worth of work in approved programs, with $160,000,000 under construction. Plans, specifications and estimates are completed for an additional $50,000,000 worth of work, with the remainder of the program still in the planning stage.

Secondary roads

Despite considerable progress and improvement in attacking the problems of secondary roads since the recent extension of federal aid into this field, enough troubles and complaints remain that the county officials' division and the American Institute of Local Highway Administration were able to stage lively sessions. Several county engineers criticized the federal-aid bridge standards as being too high for certain classes of roads; most of the local officials emphasized that only a small mileage of secondary roads is affected by federal aid, and that the great bulk of farm-to-market highways still lack funds and adequate technical attention, and the fear was expressed that maintenance charges on the federal-aid secondary system would reduce the funds available for development of other local roads.

In this latter connection, A. O. Cuthbert, Lansing, Mich., urged uniform minimum specifications for both maintenance and construction of local roads. Other speakers also urged a greater exchange of information on the local level, as an aid in establishing these specifications and better practices.

In the same vein, but from another approach, County Judge A. L. Burrus of Union City, Tenn., recommended the establishment in the state highway departments, the PRA or both, of a rural roads division that would deal directly with local units. Such a scheme has, in fact, operated successfully in Minnesota, according to Howard Bussard, president of the Minnesota County Highway Engineers Association. There, a "secondary road division" in the state highway department brings all the state specialists within easy access of the local official. Moreover, the division holds an annual four-day institute for county engineers, and through it uniform accounting procedures and new budget standards and designs have been put into practice.

As to progress on the secondary federal aid system, A. C. Leonard of the PRA reported that 11,000 mi. have been constructed, 6,800 mi. are under construction, plans have been approved for 4,700 mi. and 12,400 mi. are still in the programming stage.

That the need for carrying this work ahead rapidly is real and continuing was emphasized by J. S. Bright of the PRA who cited the high ratio (as compared with state system roads) of maintenance expenditures on secondary roads. For every dollar spent in new construction on state roads, 80-cents is spent for maintenance. On secondary roads the comparable maintenance expense is $1.75. "Increased use of mechanical methods appears to be the principal means of catching up with present highway maintenance requirements," Mr. Bright concluded.

Open forum on ice control

In one of the technical sessions, snow removal and treatment of icy pavement were widely discussed in open forum. The amount of calcium chloride to be added to abrasive materials—long a controversial question—was reported as varying from a minimum of 50 lb. to a maximum of 300 lb. per cu. yd. of abrasive materials.

Michigan prefers a coarse sand where available, and stockpiles the calcium chloride-treated material in open piles well in advance of the first snow. Onondaga County, N. Y., employs two central proportioning plants with a limited use of road-side stockpiles. Washington, D. C., has had considerable success during the past two years in providing self-service containers for chemically-treated abrasives near locations of known bad ice conditions, for convenience of spreading by public-spirited individuals. Michigan follows a similar plan.

Consensus of the forum was that mechanical spreaders have proved to be economical over hand-spreading of abrasives; equipment and maintenance costs are materially reduced by thoroughly washing trucks and spreaders after each usage; and increased safety measures are needed both for the motorist and the maintenance man during snow removal and application of abrasives.

R. B. Traver, moderator of the forum, reported most satisfactory results of recently installed radio equipment to aid his maintenance forces in snow removal. In operation only three months, the entire cost of the $16,000 installation including transmitter—ten two-way radio-equipped scout cars and trucks and 40 trucks equipped only with radio receiver sets—has been saved through reductions in labor and increased efficiency of operation.

(*Further details next week.*)

***Polite Postscript**—Three months ago (ENR Oct. 30, 1947, vol. p. 574) the General Petroleum Co. posted a sign apologizing to its neighbors for the noise riveters were making in erecting a new building in Los Angeles, Calif. With riveting completed, the owners gave a sigh of relief and posted the sign shown above to advise of the happy occasion. The structure will be 12 stories high and nearly a block long.*

HIGHLIGHTS OF MUNICIPAL DEVELOPMENTS

Smoke control programs encounter objections—Cities implement planning program—Chicago gets airport approval

Three cities attempting to push forward smoke control programs ran into a series of obstacles last week, mostly concerned with industries that were unable to comply immediately with new directions.

Los Angeles, Calif., refused to postpone imposition of legal limitations on the amount of smoke and contaminants to be emitted from industrial plants, despite the objection of a group of 30 city industrialists who met to protest the restrictions. Oil industry spokesmen in particular opposed a restriction of 0.2 percent of sulphur by volume emitted from stacks, contending that power plants, for example, burn such low grade fuel that compliance would be difficult.

At Milwaukee, Wis., where considerable opposition to a proposed smoke control ordinance has already been expressed, solid fuel business interests continued a non-stop series of talks with county officials in an attempt to delete from the proposed county smoke control ordinance the limitations on the volatile content of solid fuels. The Milwaukee ordinance was further complicated by local objections to the employment of John L. Hodges, of Jersey City, N. J., as smoke control engineer. It was revealed late in the week that Mr. Hodges, who was to take office Feb. 1, has submitted his resignation on Jan. 24 because of the adverse publicity his appointment and his insistence on restriction in the use of soft coal had created.

At Louisville, Ky., city officials watched the progress of a bill introduced into the state legislature to permit the circuit court to issue injunctions against plants emitting dust into the air, and fined violators $100 a day for each day of violation of the law. The bill, in addition to restraining present plants, would prohibit erection of any plant within ten miles of Louisville if it produced "carbide, lime, or sulphuric dust, ashes, or odors."

Planning progress

Officials of Kokomo, Ind., last week signed a $13,000 contract with Planning Services, of Indianapolis, to work out a master plan for the city and making a series of studies for land use ordinances.

Other action on the city planning front included authorization by the Nashville, Tenn., city council to its Planning Commission to make an immediate study of a proposed program of improvements for the city, taking into account a ten year public works program to cost $27,000,000. The program would provide for a sewage disposal plant, flood control installations, and a municipal auditorium.

At Seattle, Wash., the city building department said it expects shortly to recommend an amendment to the city building code to authorize substitution of light-gage steel for timber beams. The amendment would make possible a new method of building warehouses, according to John B. Cain, city building superintendent.

Approve airport programs

The Illinois Department of Aeronautics last week officially approved preliminary plans for Chicago's proposed $28,000,000 Douglas airport. The approval is subject to appropriations made by future General Assemblies of the state.

The city has done considerable work on the project in the way of planning and surveys.

Other municipal airport developments included approval by the Baltimore Airport Board of preliminary plans for a $3,000,000 terminal building at the new Friendship Church Airport, and the introduction into the Kentucky legislature of bills that would appropriate $2,000,000 as the state's share of airport costs for municipalities. Among the projects that would be provided is a new airport at Louisville.

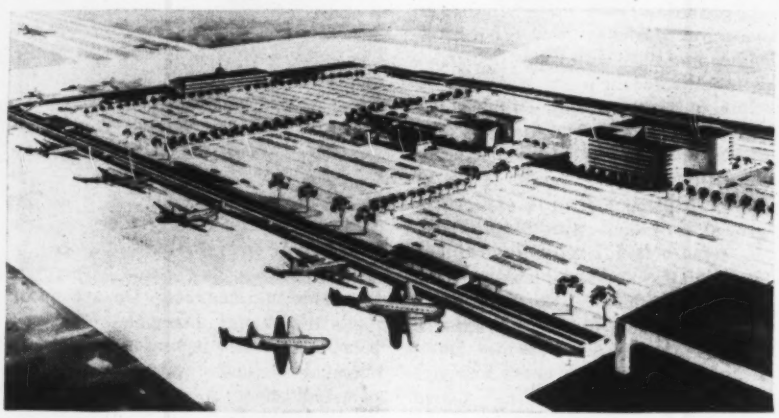
At Toledo, the City Aviation Commission received a report from M. W. Cochran, of Detroit, a consultant, disclosing that because of local weather conditions the city can develop a major airport with only two runways.

Dedicate San Diego bridge

Completion of the major unit of a $14,000,000 freeway linking the mainland section of Long Beach with the Naval installations of Terminal Island in Los Angeles-Long Beach Harbor, was marked Jan. 10 with the dedication of the Commodore Schuyler F. Heim Bridge. The vertical-lift draw bridge, largest of its type, was built by United Concrete Pipe Corp. for the Navy at a cost of approximately $5,600,000.

Built over the Cerritos channel, which connects the twin harbors of Long Beach and Los Angeles, it was named in honor of the retired former commander of the Terminal Island base.

The 6-lane bridge has a greater vertical lift and a larger movable area than any other bridge of its kind. Stretching 700 ft. from pier to pier over the water, it has a 240-ft. movable center span. Clearance between the lowered bridge and the water is 50 ft., and the center span can be raised to give 175 ft. clearance. The supporting towers rise 224 ft. above the water level.



Airport Plans—While the Minneapolis-St. Paul Metropolitan Airports Commission continues deliberations on whether to expand existing facilities at Wold-Chamberlain Field or develop an entirely new site, plans are being pushed for the actual terminal structure itself. Architects employed by the commission have prepared plans for a terminal development covering 25 to 30 acres, providing 28 loading positions for air carriers, an administration building (at the upper left of drawing) and a hotel in the center of the site. Architects are Magney, Tugler and Setter, of Minneapolis.

OBITUARY

George F. Bateman, 61, of North Plainfield, N. J., dean of the School of Engineering of Cooper Union, N. Y. City, died Jan. 29. Dean Bateman was graduated from Cooper Union in 1907 and had taught there ever since. During the first world war he served as a lieutenant in the Naval Reserve. He was named dean in 1933. He was a member of the council of the American Society for Engineering Education, and of the standing committee on professional recognition for the Engineers Council for Professional Development.

Frederick H. Johnson, 56, West Hartford, Conn., formerly senior engineer in the Connecticut State Highway Department, died Jan. 21. Mr. Johnson left the department in July, 1946, to become general superintendent of the M. A. Gammino Construction Co. of Providence, R. I.

Charles F. Lovan, 46, partner of Hillyer & Lovan, Jacksonville, Fla., was killed in an aeroplane accident recently. He was a graduate of Cornell University, 1924.

Shaler C. Houser, 68, professor of engineering at the University of Alabama for 35 years, died recently.

Otto Yenglin, 62, former city engineer of Texarkana, Tex., died there Jan. 16.

Philip R. Snelling, 45, of Lincoln, Mass., a Middlesex County engineer, died Jan. 22.

Richard Morey, 78, city engineer for Sedalia, Mo., in the 1890's, died in that city Jan. 20.

Col. Joseph C. Donovan, 81, first dean of the engineering department at Santa Clara University, died recently in San Jose, Calif. Commander of New York's "Fighting 69th" Division in the Spanish-American War, Colonel Donovan was graduated from West Point in 1888. He served with the Army Engineer Corps. After retirement, he was reconnaissance engineer in routing the Santa Fe Trail and Lincoln Highway.

Joseph E. Boyd, 49, former head of the Georgia Highway Department Laboratory of tests and materials, died Jan. 21, at Atlanta.

William T. Barry, 56, retired civil engineer, a graduate of the University of Arkansas, died at Little Rock, Ark., Jan. 19. He was in levee, railroad and highway construction work for many years. In 1938 he joined the Farm Security Administration as engineer-in charge of soil conservation projects until retirement in 1945.

Harold T. McQuiston, 56, engineer for the Nevada highway department, died Jan. 4 in Las Vegas. A graduate of the University of Nevada, he was attached to the state engineer's office from 1923 to 1934, and joined the state highway department in 1937.

Ralph E. Tarbett dies; 34 years with USPHS

Ralph E. Tarbett, 65, sanitary engineer who retired early in 1947 after 34 years with the U. S. Public Health Service, died Jan. 23 at Baltimore, Md. A 1905 sanitary engineer graduate of the Massachusetts Institute of Technology, he was one of the first sanitary engineers to be appointed to the PHS and was stationed at the steam pollution investigation station at Cincinnati, Ohio, from 1913 to 1917. From 1922-25, he was supervisor of sanitation work along the U. S.-Mexican border and was also health officer of El Paso, Tex. In 1928 Mr. Tarbett came to Washington as chief of the newly-created sanitation section of the PHS. He became chief sanitary engineer of the Office of Civilian Defense during World War II.

MAJOR MEETINGS

Associated General Contractor of America, Inc., 29th annual convention, Adolphus and Parker Hotels, Dallas, Tex., Feb. 9-12.

Associated Equipment Distributors, 29th annual meeting, Edgewater Beach Hotel, Chicago, Ill., Feb. 15-19.

U. S. Conference of Mayors, annual conference, Waldorf-Astoria Hotel, New York, N. Y., Feb. 16-18.

National Association of Home Builders, Stevens and Congress Hotels, Chicago, Ill., Feb. 22-26.

American Concrete Institute, annual convention, Shirley-Savoy Hotel, Denver, Colo., Feb. 23-26.

Ontario Good Roads Association, 46th annual meeting, Royal York Hotel, Toronto, Ont., Feb. 24-25.

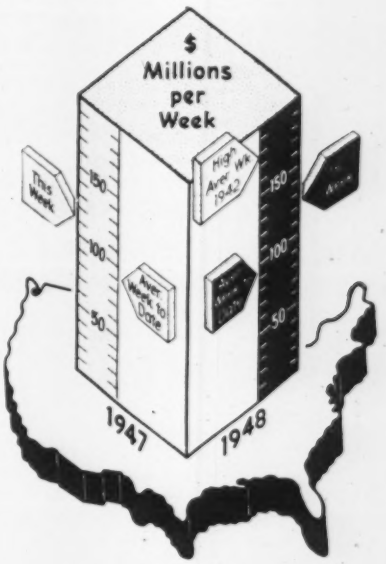
Association of Highway Officials of North Atlantic States, 24th annual meeting, Hotel Traymore, Atlantic City, N. J., March 3-5.

Mississippi Valley Conference of State Highway Departments, Edgewater Beach Hotel, Chicago, Ill., March 11-13.

American Concrete Pipe Association, Hotel Roosevelt, New Orleans, La., March 12-13.

Chicago Technical Conference, Stevens Hotel, Chicago, Ill., March 22-24.

CONSTRUCTION ACTIVITY



As Reported this week to . . .
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of Feb. 5 1948	Cumulative 1948 (6 wks.)	Cumulative 1947 (6 wks.)
Federal	$35,436	$91,603	$52,502
State & Mun.	21,737	199,996	131,961
Total Public.	$57,173	$291,599	$184,463
Total Private	66,640	274,169	358,053
U. S. Total.	**$123,813**	**$565,768**	**$542,516**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1948 (6 wks.)	Cumulative 1947 (6 wks.)
Waterworks ...	$7,263	$26,353	$15,409
Sewerage	1,836	16,966	12,244
Bridges	1,674	20,604	14,130
Highways	6,095	71,659	50,236
Earthwork, Waterways	27,499	55,527	9,248
Buildings, Public	10,202	80,020	59,363
Industrial ...	17,255	68,229	105,456
Commercial .	46,145	185,444	228,966
Unclassified	5,844	46,966	47,464

NOTE: Minimum size projects included are: Waterworks and waterway projects, $28,000; other public works, $50,000; industrial buildings, $68,000; other buildings, $250,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1948 (6 wks.)	Cumulative 1947 (6 wks.)
NON-FEDERAL	$244,106	$120,554
Corporate Securities	120,384	5,868
State and Municipal	123,722	114,686
**Total Capital ..... **	**$244,106**	**$120,554**

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost	Feb. '48	436.89	210.01
Building Cost	Feb. '48	329.71	178.23
Volume	Jan. '48	175	77

EDITORIALS

VOLUME 140 NUMBER 6

February 5, 1948

Toll Roads vs. Free Roads

DISCUSSION of the pros and cons of toll roads at the ASCE meeting in New York recently brought out that although highway administrators do not want toll roads they have no alternative to suggest for those areas needing superhighways and yet lacking the tax money to build them. This journal has always opposed toll roads, believing that there is usually ample gas-tax money collected to build them as free roads. Yet there are instances where the hard facts of politics or economics make an exception necessary as was ably brought out by highway administrators who spoke at the ASCE forum. But representatives of the Public Roads Administration were adamant against any such concession. Admirable as it may be to support an idealistic objective, it is not always realistic or constructive. Now would be a good time for the PRA, which did such a magnificent job a decade ago in directing the nation's thinking on a proper course with respect to toll-roads to re-examine the question. Now, as then, it may find locations where traffic, high costs, or special political situations, justify a toll facility. A new guide is needed.

Bearing Power from Hammer Blows

WHETHER the number of hammer blows for the last few inches of driving is a dependable measure of the bearing power of piles has long been questioned. This questioning on the part of those responsible for foundations at the Stuyvesant Town housing development led to extensive tests that proved, for the piles used and when driven deeply into water-bearing sand, that greater supporting value was available than was indicated by conventional formulas. From the tests, criteria were developed for field guidance that assured dependable group foundations at savings many times the $100,000 cost of the tests. Such data, derived for only one type of pile in particular soils, are valuable as a guide for other areas—but they should be used only as a guide, to be verified by adequate tests for each use. There may be a thought for the future in the fact that the total number of blows struck in forcing a pile into bearing strata at Stuyvesant Town is of more significance than the blows used for the final inches of penetration. But much testing as well as sharing of available data, will be necessary to develop these ideas into dependable driving criteria.

What Kind of Security?

"THE ONLY SECURITY a young engineer should worry about is security of opportunity!" This is the advice given members of the National Society of Professional Engineers by Harry A. Winne, vice-president of the General Electric Co., at the society's recent annual meeting. Too many young men today, he added, are more concerned with tenure and pay than with the opportunities offered by industry. Mr. Winne's advice should be impressed upon the young men coming out of our engineering schools year after year if the nation is to maintain an adequate supply of the type of engineers who contributed so largely to making this country what it is today. Much is said these days about the lack of "venture capital", which is held to be an essential element in our economic system. But we need a greater supply of venture brain and brawn as well, the type of man who takes a job for the challenge it holds for him, not for what it pays or for how long. There may be no security in such a job, but in the aggregate it is such jobs that keep the door of opportunity wide open.

Bridges Cost Too Much

BRIDGE BUILDING is taking an increasing percentage of the highway dollar, and economies in design are in the spotlight. In this regard, E. H. Thomas, Montana bridge plans engineer, pointed out before a recent Western highway officials meeting that savings can be made in fabrication. Bridge elements can be designed to make best use of mechanical equipment now available. Most shops are equipped to make reliable welds, and full advantage should be taken of any economies resulting from welded design. Excessive fabrication can in some cases be avoided by the use of additional material; the use of rolled sections of greater weight than necessary often is less costly than building up sections to exact requirements. A move could also be made toward more standardization of bridge members and sections. All of these suggestions may be generalized in the statement that reduction of on-the-job labor and of the use of specially fabricated pieces will

lower bridge costs. And if less can be spent for bridges more miles of improved highway can be produced per dollar of investment available.

A City Within a City

A LARGE PART of this issue is devoted to a huge apartment house development in New York City that typifies a trend and represents a promising mode of attack on the decaying cores of our large cities. Stuyvesant Town is a rental housing project, built and financed by private capital under New York State's Urban Redevelopment Companies Law. Through concessions in the form of limited tax relief and land condemnation, the act was planned to attract the accumulations of capital held by insurance companies and savings banks to large housing and slum clearance projects.

Stuyvesant Town represents a successful attainment of this objective. Because of its size, it benefited from out-of-ordinary planning design and construction, which is the justification for its extensive treatment in this issue. The large investment also permitted, even required, economy wherever possible, and thus it is that the project is noted for several innovations—in design and methods of construction.

But the emphasis placed on design and construction precludes discussion in the articles of some of the considerations with respect to urban redevelopment and the New York State law that Stuyvesant Town revealed. One of these that may be mentioned here is that a redevelopment corporation whose income is limited by law will be hesitant about building during a period of rising construction costs unless the law makes some provision for lessening the risk.

Experiences at Stuyvesant Town also make clear that selection of a built-up urban site for a housing project to take advantage of existing facilities may not always be economical. Utilities may have to be abandoned because of age, inadequate capacity or poor positioning with respect to the new buildings. Streets may have to be relocated, and transportation facilities may be severely strained by increased population density.

Perhaps more concessions than exercise of the eminent-domain power and the tax relief currently granted may be needed if private funds are to be attracted for investment in urban redevelopment under present inflationary conditions. Capital grants or donations of land by municipalities, for instance, might be considered.

Construction Capacity

IS THE CONSTRUCTION INDUSTRY big enough to handle the total of the jobs waiting to be done? In so far as roadbuilding is concerned, Thomas H. MacDonald, Commissioner, Public Roads Administration told the American Road Builders Association last week that adequate capacity is definitely lacking. Not only is work being offered faster than it can be absorbed, but during the past two years 40 percent of all federal-aid road contracts have failed to be completed on time. In view of our great need for highways, this reflects a serious hazard, the more so since there is money and administrative organization available to handle a bigger program.

Unfortunately the problem is not easy of solution, and largely because what is called the capacity of the construction industry is a very elusive and changing characteristic. The number and size of contracting units is one variable, but this in turn is affected by the available supply of equipment and materials, by the profit possibilities, which in turn are related to the level of construction costs, and by the supply of credit and capital. In the latter connection, Mr. MacDonald pointed out that ten years ago an equipment investment of 50 percent of the contract volume of roadbuilding was the rule, whereas now the figure is closer to 90 percent.

To take account of such a situation Mr. MacDonald proposed more efficient use of the roadbuilding capacity now in existence by providing a better continuity of work. Were a definite volume of construction assured year by year, not only could existing contractors order their operations more efficiently, but new contractors would be more willing and able to make the necessary equipment investments. Most public work is discretionary as to timing, said Mr. MacDonald, but roadbuilding is continuous. It is a thought for roadbuilding bodies to ponder, at the same time that the roadbuilders themselves are digesting the charge that they are lacking in capacity to do the job that needs to be done.

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Innovations In Bridge Pier Concrete

Col. C. C. Frech
District Engineer Philadelphia District
Corps of Engineers, U.S. Army

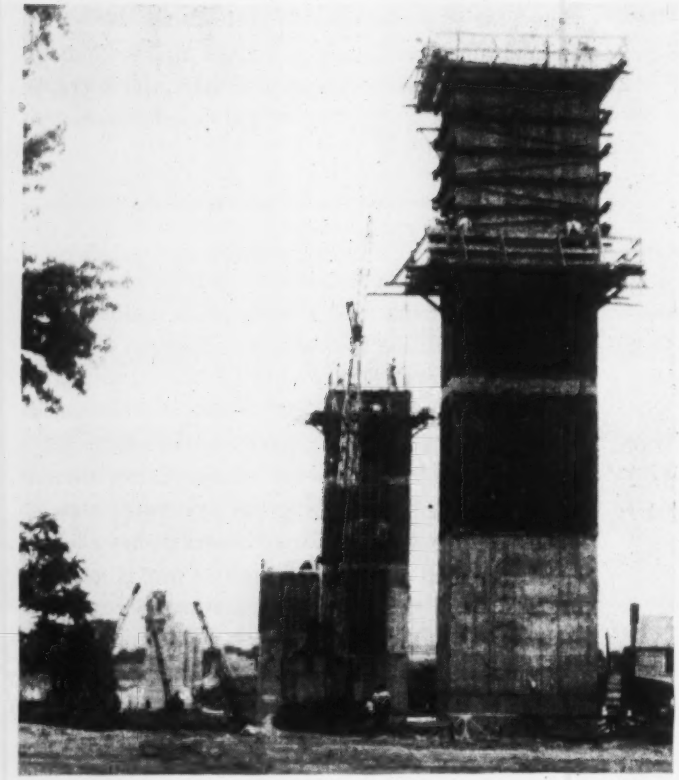


Fig. 1. Tall piers for a bridge over the Chesapeake and Delaware Canal were made of air-entrained concrete placed in panel forms.

***Contents in Brief**—Several factors contributed to the exceptionally good and attractive concrete in high piers for a bridge over the Chesapeake and Delaware Canal. Heavy wood forms were bolted throughout and utilize steel wales to reduce interior ties to a minimum. Absorptive form liners were dampened to prevent creep and attached to them with grease. Of particular interest is the item of edge chamfer where extruded rubber shapes, attached with rubber cement, proved economical in first cost, eliminated rubbing and improved the appearance of the concrete.*

AIR-ENTRAINED concrete, absorptive form liner and edge chamfers of extruded rubber all were utilized to produce high quality concrete in tall piers recently completed for a bridge at Chesapeake City, Md. The new structure will span the Chesapeake and Delaware Ship Canal with a tied steel arch 540 ft. long at a height of 135 ft. above the canal. Approach spans are deck girders varying in length from 30 to 136 ft. and give a total length of structure of 3,954 ft.

The bridge replaces a 260-ft. lift span bridge completely wrecked by a freighter, *ENR* Aug 6, 1942, vol. p. 197, and will eliminate a temporary ferry that costs $250,000 per year. The bridge provides a 24-ft. roadway and a 4-ft. sidewalk.

Piers near the canal are high to provide the required navigation clearance. Those at the channel edge, for the main span arch, are double-shaft structures rising to a height of 160 ft. Beyond these, to carry the approach structure, are 18 single-shaft piers on the south side of the canal and 14 on the north side.

The approach piers have a constant dimension of 15 ft. transverse to the bridge center line and a top width of 5 ft. 6 in. to 7 ft. 6 in., increasing to accommodate the greater space necessary for larger shoes of the longer spans. The piers are tapered $\frac{3}{16}$-in. per ft. of height on the sides transverse to the bridge but are vertical on the pier ends.

Air-entraining cement was used for all of the concrete. The mix was designed in the Corps of Engineers concrete laboratory at Mount Vernon, N. Y., for locally available gravel aggregates up to 2½-in. size. A 28-day strength of 4,200 psi. was attained with a theoretical cement factor of five bags of cement per cubic yard. Using a water-cement ratio of 5.4 and an actual cement factor of not less than 4.75 bags per cubic yard, the slump was about 2½ in.

Specifications for the project require 4.5 percent air with a permissible tolerance of plus or minus 1.5 percent. The air-entraining agent was included in the cement at the mill, which simplified field batching but precluded a quick, positive control on the amount of air in the concrete by changing the amount of air-entraining agent used.

Findings on air entrainment

At first, the percentage of air entrained in the mix was in delicate balance and sometimes exceeded the upper limit set for entrained air. Actual entrainment was upset by variation in mixing time, type of mixer,

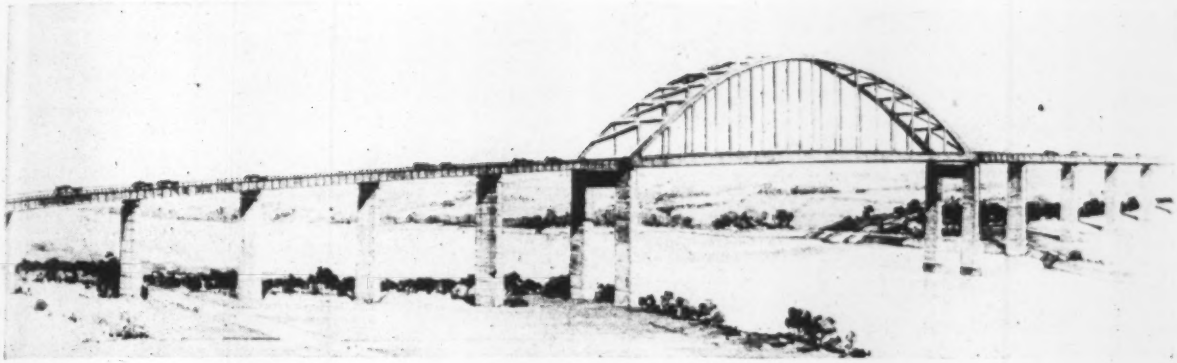


Fig. 2. The 540-ft. tied steel arch is to be carried on double-shaft piers while single shafts will carry the approach girders.

temperature of mix and changes in proportions or consistency.

Tests, observations and adjustments on air entrainment were made with assistance of Portland Cement Association technicians. From the observations made, several conclusions were drawn:

1. The time of mixing in transit-mix trucks, within normal limits, had no effect on the amount of air entrained.

2. Variations in standard types of transit-mix trucks had no effect on amount of air entrained.

3. Reduction of the ratio of sand to total aggregate to below the 31 percent established by the original laboratory mix design had little effect upon the amount of entrained air. Reduction below 28 percent impaired the workability of the concrete.

4. Temperature of the mix seemed to have a direct bearing on the air entrainment. Over a range of temperatures from 45 to 80 deg. there was a reduction of air content of two percent at the higher temperature.

5. In the range of ½-in. to 3½-in. slumps tested, any increase in slump was accompanied by an increase in air content.

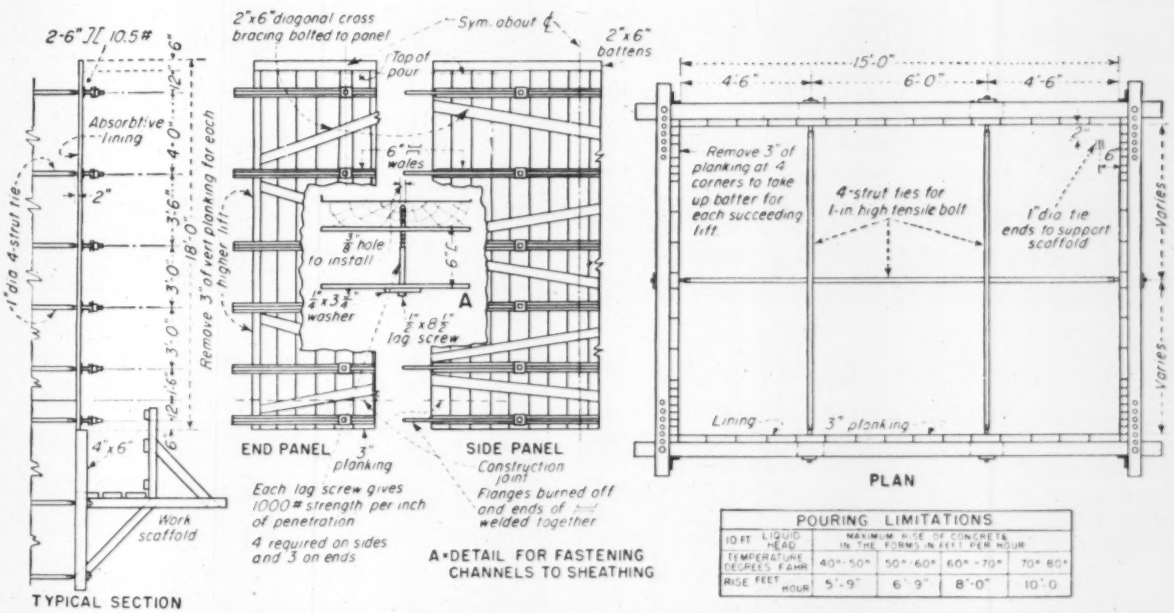
Entrained air controlled

It was found that control of the air content was most easily effected by careful control of the consistency of the mix. For slumps of 1½ to 2 in. control of entrained air was not difficult. For 3-in. slump, entrained air ran as high as two percent over the maximum allowable.

The air-entrained concrete was highly workable, so reduction in slump from the mix design of 2½ in. to the range 1½ in. to 2 in. produced no real hardship. Some difficulty was encountered in depositing the concrete from buckets and through "elephant trunk" chutes because of the high cohesiveness of the mix. Normally, the mix handled well and worked into place with a little vibration.

Concrete surfaces throughout the job are entirely free from honeycomb, a major factor in the appearance of the structure. No spading or use of vibrators within 6 in. of the form surface was permitted, to prevent marring of the form liner. The lack of surface honeycomb or rock pockets, despite this limitation, speaks for the merits of the air-entraining mix.

In the final analysis, control of air did not prove to be a serious problem with the materials available for



POURING LIMITATIONS				
10 FT. LIQUID HEAD	MAXIMUM RISE OF CONCRETE IN THE FORMS IN FEET PER HOUR			
TEMPERATURE DEGREES FAHR.	40°-50°	50°-60°	60°-70°	70°-80°
RISE FEET / HOUR	5'-9"	6'-9"	8'-0"	10'-0"

Fig. 3. Heavy panels with channel wales and few interior ties were faced with absorptive liner to improve concrete appearance.

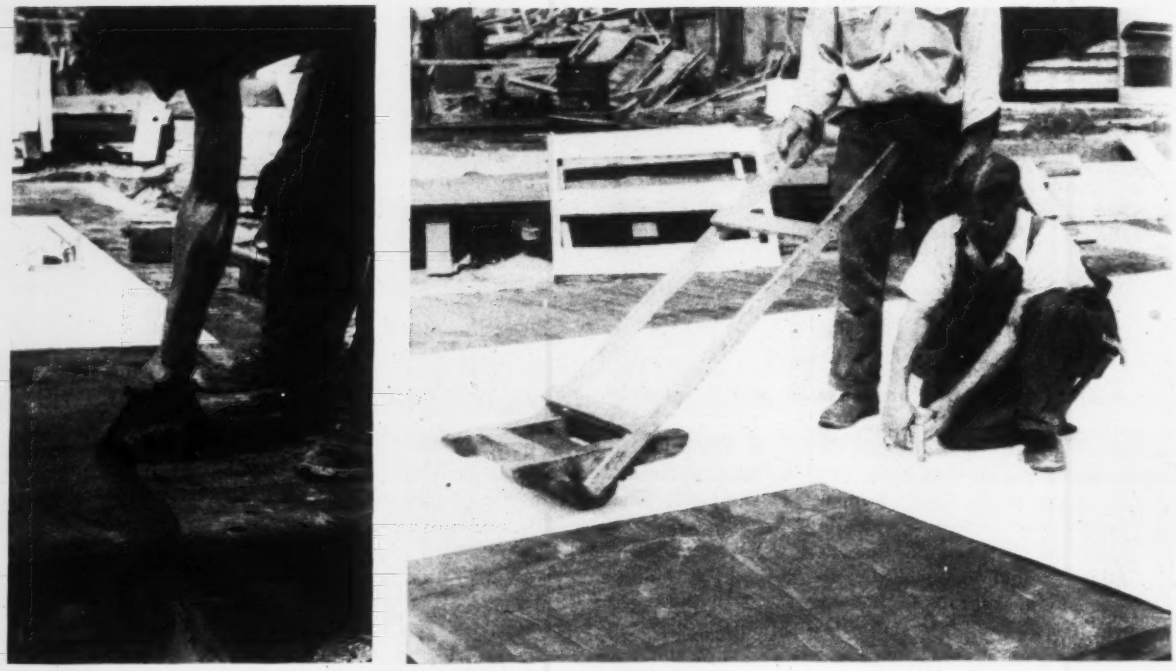


Fig. 4. Grease and staples hold absorptive liner to pier form panel. Grease is applied with a linoleum-cement spreader. Staples, driven by a spring-gun, hold the edges.

concrete on this job and with the air entraining agent interground with the cement at the mill. Nevertheless, our experience indicates that it is desirable, whenever the size of the work warrants, to make provisions for adding the air-entraining agent at the batcher or mixer to gain positive control of air. Under varying conditions of temperature and aggregates some times encountered, this positive control might be of inestimable value.

Absorptive liner on heavy forms

So far as appearance is concerned, other factors are fully as important as quality concrete. Exceptionally sturdy forms were used for all exposed surfaces and these were lined with a thin, absorbent paperboard faced with muslin.

Forms were built of 3x10 S4S plank set vertical and bolted to six double 6-in. 10.5-lb channels for a 16-ft. lift of concrete. The center plank of each end form was cut on each side to the $\frac{3}{16}$-in. per ft. slope (3 in. for a 16-ft. height) required for the end batter of the pier. At the edges, the planks were 3 in. wide so that they could be removed successively to fit inside the side forms as the concreting operations moved upward. To stiffen both end and side forms, 2x6-in. members were attached diagonally between the wales. Forms were made up entirely with bolts, all of the planks being laid with a $\frac{1}{8}$-in. opening between them to allow for expansion without distortion. After assembly, the forms were planed and sanded to eliminate irregularities.

Channel wales on the long side panels were brought together at the ends and the flanges were coped to slide between the channels of the end panels. Pins and wedges were used to make the side channels serve as ties so that only a single tie was used at the center of the pier end, despite a maximum width of 15 ft. Across the long side of the pier two ties were used in each of the six pairs of channels.

Ties were four 0.34-dia. high-tensile wires, welded at each end to a $1\frac{1}{2}$-in. long coil of wire that served as a thread for a 1-in. coarse-threaded bolt. The tie had a breaking strength of 38,000 psi. and a working strength of 24,000 psi.

New ideas in absorptive lining

The art of attaching and using absorptive form liner was substantially advanced by experiments performed by the contractor on this project. Stationer's staples have ordinarily been used in very considerable numbers for fastening with rows along each edge and at 4 to 6-in. centers over the entire surface. Where absorptive liner has been used on steel forms grease has served to hold the liner—if the edges could be prevented from starting to curl.

The method found satisfactory for use on wood forms for the bridge piers was to put on No. 3 grease with a linoleum-cement spreader, lay the liner on the grease, roll it for uniform contact and fasten the edges with the staples. This worked very well, except for the problem of expansion of the paper as it absorbs moisture from the air prior to placing concrete.

Liner expansion overcome

Warping of the absorptive liner as it expanded from moisture absorbed prior to placing of concrete proved quite serious. Leaving joints open to as much as $\frac{1}{2}$ in. was tried but it was difficult to guess the extent to which expansion would occur and, in addition, expansion was entirely different with and across the "grain" of the paper. If sufficient room was not allowed for expansion, the paper pushed up into a raised area that pres-

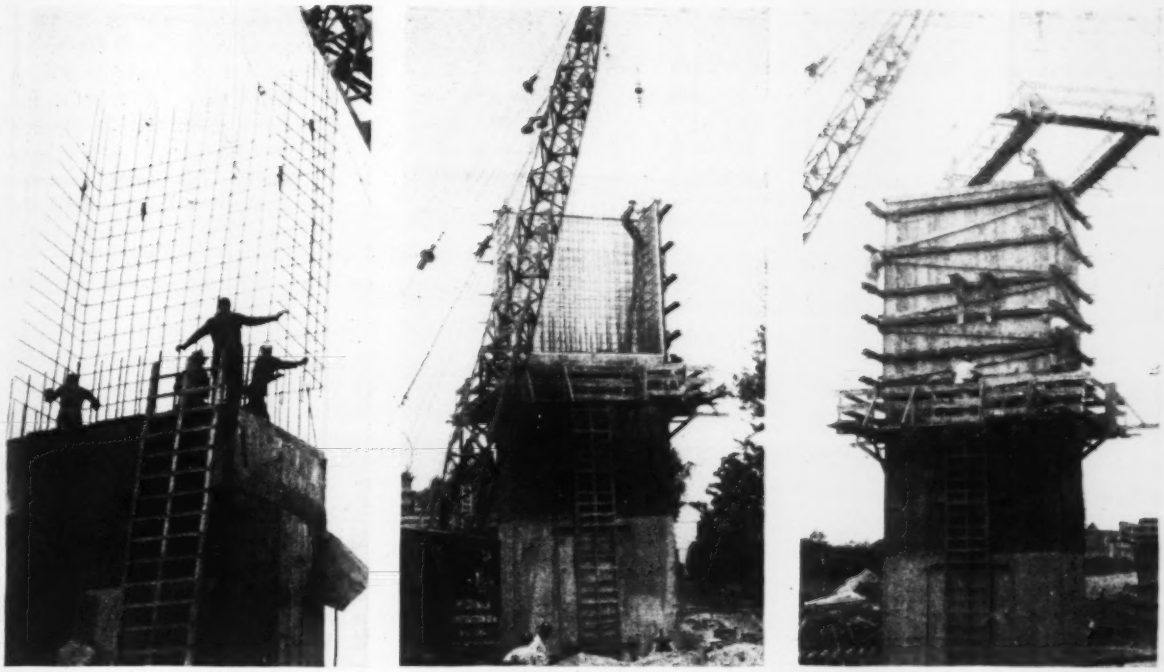


Fig. 5. Three steps in preparing a 16-ft. lift for placing concrete. Assembled half of reinforcing cage is set, lined forms are positioned around reinforcing and top scaffold is swung into position as workmen fasten forms.

sure of concrete against the forms did not overcome. Sometimes the paper contracted and pulled the staples from the form.

A solution to the problem was found in sprinkling the back of the absorptive liner a few minutes before it is put on the forms. Water was applied from a garden variety sprinkling can in an amount just sufficient to cause expansion.

This "tempering" of the liner expands it to the shape it would assume under humid air conditions and eliminates the difficulty from warping. The light wetting does not appreciably lessen the value of the absorptive liner in drawing water from the face of the concrete as excess moisture dries out before concrete is placed, leaving the liner firmly stretched against the forms. (Another method used to eliminate warping is heat, see *ENR* July 24, 1947, vol. p. 111).

Routine of erection

The cycle in preparing a 16-ft. lift of pier for concrete placing was as follows: Brackets were attached to the pier by bolts turned into previously used ties to support the form panels in raised position and make a work scaffold, Fig. 3. Preassembled reinforcing was set in two half-cages and tied.

Meanwhile, absorptive liners were placed on the four form panels as they lay on the ground. Grease was applied to the form, the liner being laid with a space held by an 8d nail between the sheets in the direction of principal expansion. The edges were butted tight in the other direction.

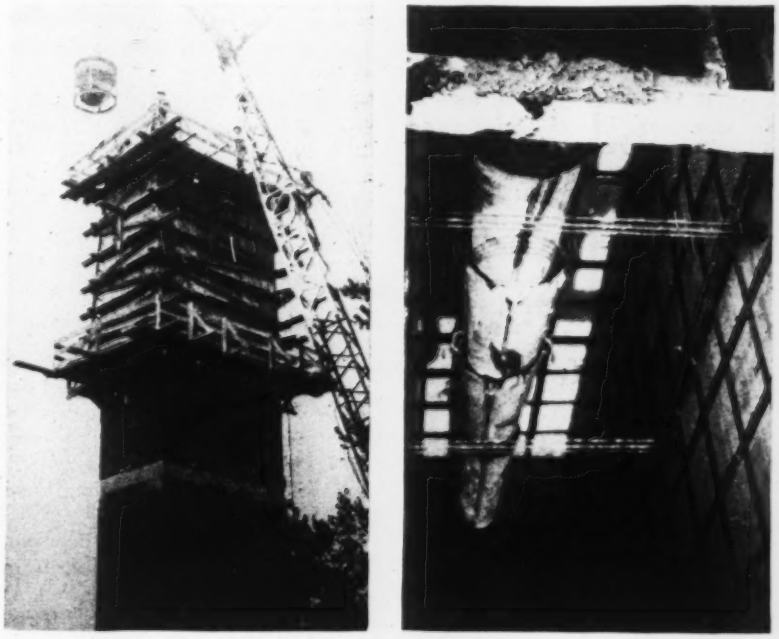


Fig. 6. Concrete was placed by bucket and long-boom crane, being dumped through an elephant-trunk spout to bottom of 16-ft. high absorptive-paper lined form. Black line just beyond four-strut tie is rubber V-strip for pier decoration.

Sheets were smoothed down into the grease by a small roller made from a house-movers dolly, Fig. 4, and the edges were stapled.

The form was erected just before it was to be concreted, tarpaulins being used previously to protect the liner from moisture changes.

Form assembly was preceded by setting wedges and small screw jacks on the brackets to level each of the panels, which were swung into place separately by a crane. Pins through the corners locked the forms and cross ties were inserted. A work platform was set on the top of the forms. Diagonal cross ties of $\frac{5}{8}$ in. dia. cable outside the form on the long side stiffened it against wracking and assisted in plumbing it.

Ten sets of forms were constructed for about 140 lifts on the 32 single-shaft piers. Usual procedure was to adjust the form to the correct size for a lift and then use it to place concrete on three adjacent piers before again reducing the size. The same forms were used, after modification, for the two main piers, where the two single shafts are 12 ft. 6 in. x 13 ft. 6 in. at the top and are battered $\frac{3}{16}$ in. per ft. on three of the sides.

Something new in chamber strips

Edges and joints on the piers were made uniform and regular by use of extruded rubber chamfer strips. The same material was used at horizontal joints as well as for vertical decorative treatment. Use of rubber strips eliminated the warping and irregularities frequently encountered in wood.

The rubber was attached to the form with rubber cement, a single nail at the top of a vertical length being used to keep it from starting to "peel" off the form. For the horizontal strip at the top of the form, wood protection was used above the rubber to prevent its being stepped on and loosened.

Use of rubber for chamfer strip was developed jointly by the contractor and U. S. Rubber Co. The rubber appears to be good for any number of uses; it is easy to apply; it pulls off without difficulty, leaving neat edges that require no finishing. Cost of 45 deg. strip with a width of $1\frac{5}{8}$ in. on the square sides is about 12c. per lin. ft. and for 1 in. is 9c. Rubber can be extruded in almost any desired shape, requiring only fashioning of a die, at a cost around $50.

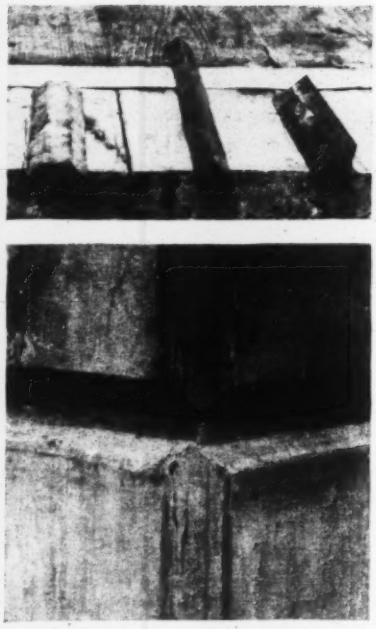


Fig. 7. Horizontal joints were made by ¾-in. thick rubber shape at left (above); small V was used vertically in piers at 4 ft. from each side, and large V at corners. None of the concrete will be rubbed.

Concrete for the piers was placed by long-boom cranes, using jibs to give them a reach over piers rising more than 100 ft. above the ground. Bottom-dump buckets transferred the concrete from the transit-mix trucks to the forms where it was dumped through small hoppers and elephant-trunk spouts to the 16-ft. depth of the form. The air-entrained concrete is entirely free from segregation. Internal vibration was used but vibrating was done carefully and only inside the reinforcing cage, to avoid damaging the form liner.

Forms removed after five days

Forms were kept on the piers for a period of five days, with the stipulation that the absorptive paper remain for the 14-day curing period. Grease on the outside of the absorptive paper helped to prevent drying out of the concrete.

In nearly all cases the liner adhered to the concrete so that the form sections would be stripped off readily and laid down to be lined for reuse. Usually there was no serious difficulty in pulling the liner from the concrete immediately after the specified curing period. Removal was done by hand by tearing off small sections of the cloth facing. If the liner is left on much longer than 14 days it frequently is very difficult to remove.

Because the bridge is over a navigation channel, the Corps of Engineers is charged with providing and maintaining it at the expense of the federal government. Design and supervision of construction is being done for the Corps of Engineers by Parsons, Brinckerhoff, Hogan & MacDonald of New York, for whom M. N. Quade is project manager and William H. Bruce is resident engineer. Lewis Caccese handles liaison on the project for the Philadelphia Engineer District.

Fehlhaber Pile Co., Inc., of New York City holds a contract of about $1,200,000 for the substructure. Aaron Burros is superintendent, S. J. Winterberg is chief engineer, and W. L. Stone is field engineer on the project.

Guard Fences Where Fatal Accidents Occur

Guard fences should be constructed along highways wherever a fatal accident is due to a car running off the embankment. This was the recommendation made at a recent meeting of Western highway maintenance engineers and is the practice followed in considerable number of the Far Western states.

Advantages claimed for constructing guard fences at fatal accident sites include the following: That site is presumed to have been proven more dangerous than other sites because a fatal accident occurred there. The local motoring public will demand some sort of protection and will feel the highway department is doing a good safe job when such fences are built.

Because of the many miles of Western highways in the open country potentially subject to the danger of cars running off the embankment, it is considered impractical and expensive to guard-fence completely. Instead, sight posts with reflectors or luminous paint are used until the necessity for guard-fence construction is demonstrated when a fatal accident occurs.

Concrete Jacketing H-piles in Soft Mud

ANY reasonable depth of H-pile in soft mud can be cleaned and jacketed with concrete in 15 min. at the cost of the concrete plus the charge for a pile-driver rig and crew. Such jacketing was developed for protection of foundation piles for a turbine building at the Schenectady, N. Y., Works of General Electric Co.

Cleaning is done as the first phase of the jacketing operation. A steel casing 2 in. larger in each dimension than the 12-in. 65-lb. pile and a plunger to operate inside the casing is all the special equipment needed.

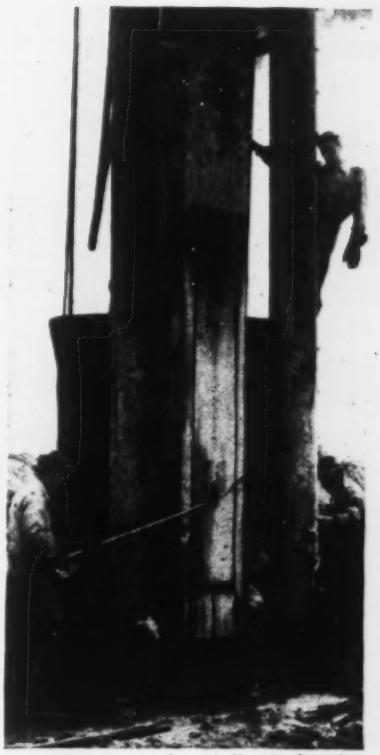
The casing is made of channels for two sides, with $\frac{3}{8}$ in. plates welded to them to form a 16-in. square shell 3 ft. longer than the jacketing depth. The business end, bottom, of the plunger is a 2-in. thick plate cut to fit tightly inside the casing, with slots burned out to match the H-contour of the pile, allowing only a $\frac{1}{8}$-in. tolerance. Tees or channels are welded to the plate so that as they slide along the web of the pile they act as a guide for the casing. At the top, a $\frac{3}{4}$-in. flat plate is welded to the verticals to hold them together and serve as striking plate for the hammer.

Casing the piles at the General Electric Co. plant is done by a separate and much lighter rig than is needed for driving. A foot-deep excavation is made around the pile head and some 3 cu. ft. of stiff, coarse concrete deposited around the top of the pile. Over this, the casing and plunger are set, with the plunger plate started on the H-pile.

Pile cleaned by concrete

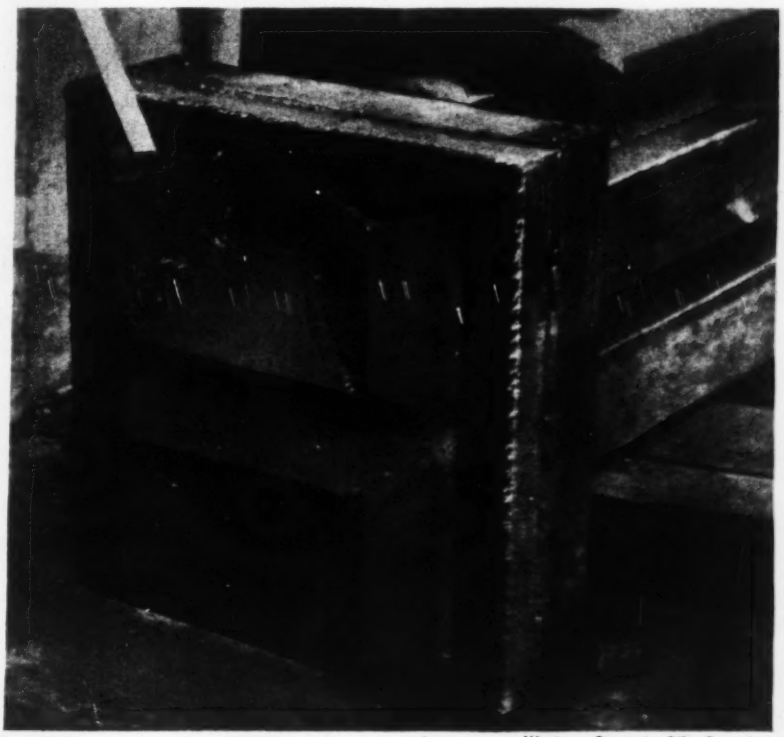
Having the casing longer than the plunger assures holding the concrete around the pile as the jacketing apparatus is forced down. But the real secret of cleaning mud from the pile is a 3-in. angle with the edges welded to the plate around the H-shape slot. This funnels the concrete in against the steel as the pile hammer forces both casing and plunger down, scouring the dirt from the pile.

When the desired depth is reached, the casing is held down while the plunger is lifted out. Concrete is placed to fill the casing to a little above the ground line. The plunger is used to force the concrete out into the space left as the casing is withdrawn, leaving a completely filled hole and an adequately coated pile.



General Electric Co. photo

Fig. 1. A small amount of concrete is placed around the head of the pile and the casing and plunger set over the pile.



Western Concrete Pile Co. photo

Fig. 2. Bottom of the plunger has angles welded around the H-shape slot to force concrete against the pile and clean mud from the steel.

An average of 30 to 40 piles per day are being coated to a depth of 8 ft. on the work at Schenectady. The crew required is a foreman, operator and oiler on the driver, four pile driver men and two wheeling concrete, a total of nine.

Ground at the site is a miscellaneous fill with a high ground-water level. There is a possibility that stray electric currents will cause an electrolysis that will harm the steel, hence the need for coating.

The method of jacketing used was developed by the Western Concrete Pile Co., New York, subcontractor for driving the 4,600 H-piles used for the turbine plant. General engineering and construction on the project is handled by Stone & Webster Engineering Corp. The General Electric Co. is represented on the work by its building subsidiary, General Electric Realty Corp.

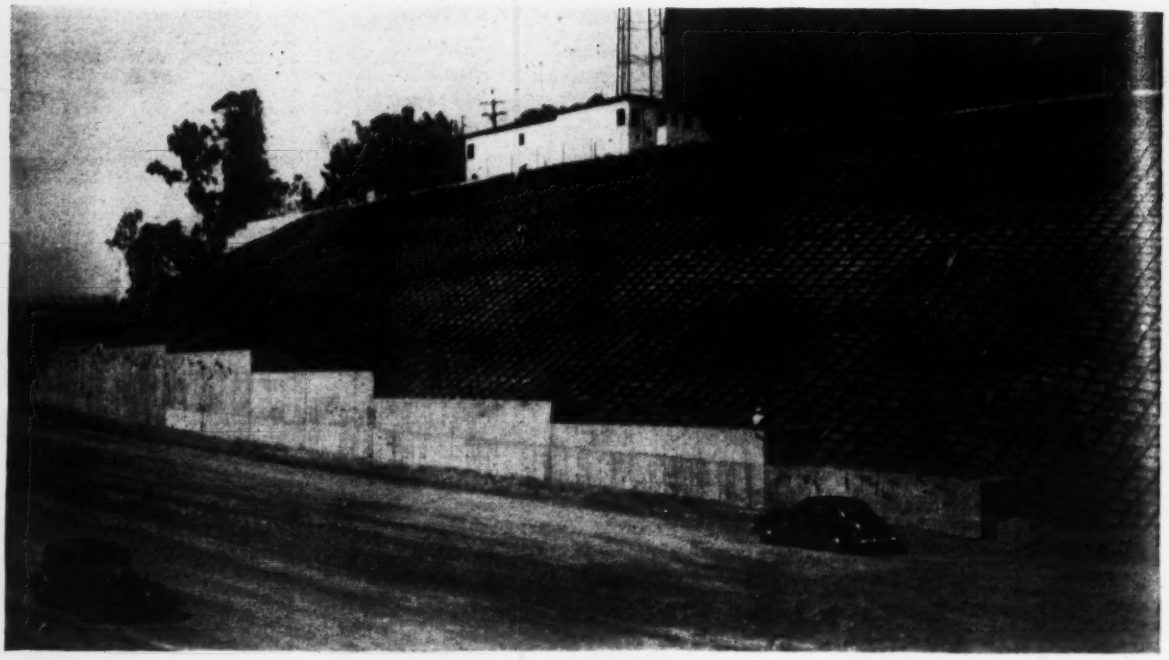


Fig. 1. To hold soil on steep slopes of the Santa Ana Freeway, frames made of 2x4-in. lumber spaced 2x3 ft. were used.

California Plants Freeway Side Slopes

***Contents in Brief**—Economy of highway maintenance is obtained by reducing erosion through side slope stabilization programs. Recent improved methods employed on California freeways include the use of wooden frames and hold soil and plants on the steep slopes.*

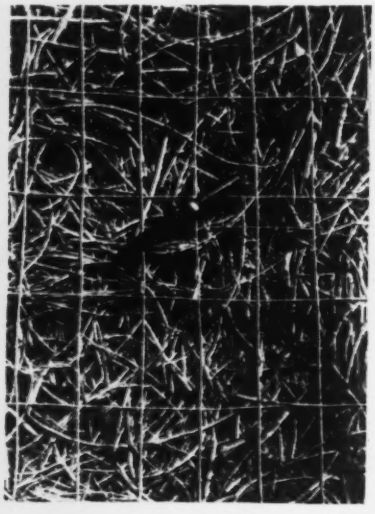


Fig. 2. Wire mesh holds straw on newly placed side slope soil.

STABILIZATION of side slopes on the Santa Ana Freeway by soil retention and by growing ground cover is typical of recent California practice. On this job, some 5 percent of the total cost went for landscaping, including this type of protection. Such an expenditure is justified by reduced maintenance costs and increased safety as side slope erosion is materially lessened, especially during the early life of the project.

As carried out in California, the work of side slope stabilization is meant to perform two functions: The shape of the slope is maintained by holding soil in place and a base or foundation is provided for permanent landscaping. As explained in the accompanying box, three different methods are used depending on steepness of side slope. On the Santa Ana Freeway, although maximum side slope was only $1\frac{1}{2}$:1, Type A stabilization was used in many places. Lack of working space—particularly at the top of the cuts—in which to repair damage in the event of heavy storms dictated the desirability of a higher type stabilization.

The basic structure used to hold soil on steep slopes consists of wooden frames made of 2x4-in. lumber spaced 2x3-ft. These frames are nailed together and, on high slopes, are anchored into the ground by stakes. Soil is then placed in these frames and is compacted. On the Santa Ana job, cranes with 110-ft. booms were required to place the soil.

Straw Protects Soil

On cuts where a good quality top soil is not naturally available, a 6-in. layer is imported. This is protected by a 6-in. layer of straw spread by use of pitchforks. The straw not only keeps the soil from blowing

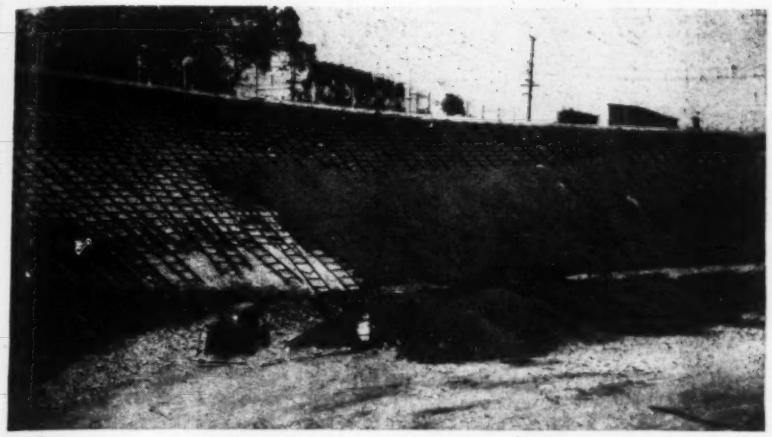


Fig. 3. The wooden frames are filled with a good quality top soil and later covered with straw and wire mesh, after which the ground-cover plants are set through the straw with their roots in the soil.

Fig. 4. On flatter slopes, straw is embedded into the soil by a sheepsfoot roller and no wire mesh is used.

STEP BY STEP STABILIZATION METHODS

Type A—For 1:1 Slopes

1. Soil retaining frames laid on slope and, on slopes over 15 ft. high (slope distance), frames secured with stakes driven 1 ft. into the subsoil.
2. Galvanized tie wires (14 ga.) attached for anchoring wire mesh.
3. Frames filled with moist top soil. Soil compacted.
4. Straw spread over slope and fertilizer placed.
5. Wire mesh, 14-gage, 4-in. mesh, placed and anchored to frames by tie wires. Wire mesh is extended at least 6 in. back of the top of the slope and buried in trench to anchor it.
6. Ground cover plants planted through straw into the top soil.

Type B—For 1½:1 Slopes

1. Slope covered with moist top soil compacted to 6-in. thickness.
2. Straw spread over slope and fertilizer placed.
3. Wire mesh, 2-in. poultry netting or 4-in. mesh, placed and anchored with 2x2x18-in. stakes spaced 3 ft. apart in staggered rows.
4. Planting done through straw into top soil. However, if slope is seeded, the seed is sown before placing straw.

Type C—For 2:1 or Flatter Slopes

1. Slope covered with 6 in. of top soil or, if top soil is not available, slope cultivated 4 to 6 in. deep. Fertilizer applied.
2. Straw spread and embedded into loose soil by means of a sheep's foot roller.
3. Planting done through straw into top soil. However, if slope is seeded, two-thirds of the seed is sown before application of straw and one-third after.

away due to wind action and washing away in rain storms but also acts as a mulch for growing plant. Eventually, the straw disintegrates and loses its protective effect; but, by this time, the plants are usually well enough developed to hold the soil.

In most instances, a 6-9-6 commercial fertilizer (nitrogen-phosphorus-potash) is spread at the rate of 30 lb. per 1,000 sq.ft. This is aimed at giving the plants an effective start so a good root structure and thick foliage will soon develop. Final step in the stabilization program is placing in position of the wire mesh. Plants are planted by hand through the straw or, in the case of seeding, seeds are sometimes sown both before and after the straw is placed.

On the flatter slopes where top soil is not readily available, the slope is fertilized and cultivated and then straw is worked into the surface by a sheepsfoot roller before planting.

Plants used, of course, vary with location as California has a variety of climates. English ivy, honeysuckle, vinca and trailing lantana are among the most commonly used plants. When these plants become well established, the roots work down through the imported soil into the subsoil. Thus, the two become well bound together. The wooden frames will, after a few years, rot out. However, by this time, the soil and subsoil are well amalgamated by the plants and the frames are no longer required.

Sprinkling systems are usually installed on this type of stabilization. On the Santa Ana work, the piping was placed first and the sprinkling heads made high enough to project through the soil and straw. It is planned on future projects to install a sprinkling system on top of the stabilization rather than underneath to facilitate pipeline repair.

G. C. McCoy is state highway engineer and S. V. Cortelyou is assistant state highway engineer for District VII wherein the Santa Ana Freeway lies. Landscape engineer for the California Division of Highways in charge of this type of work is H. Dana Bowers. Resident engineer on the Santa Ana Freeway was E. A. Parker.

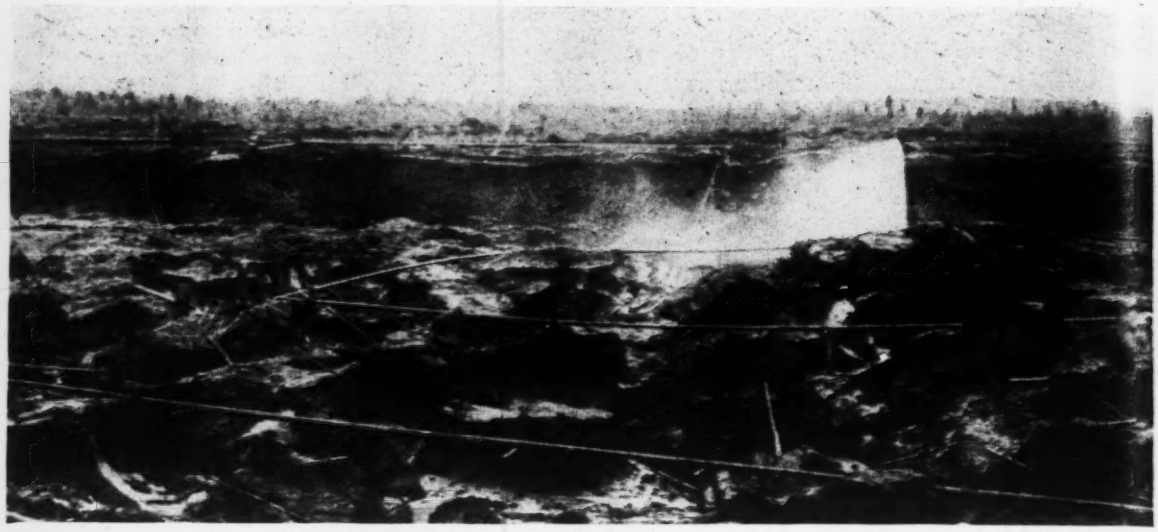


Fig. 1. Several hundred sprinkler heads delivering water at 52 deg. F., melted off 4 to 6 in. of frozen overburden per day.

Earth-Fill Dam Built on Frozen Ground

***Contents in Brief**—Permanently frozen ground governed construction methods at Hess Creek Dam in Alaska. Sprinkling was found preferable to hydraulic jet sluicing in removing frozen overburden. A refrigeration system was installed for the purpose of speeding refreezing of foundations in the areas that would be exposed and hence partially thawed during construction operations.*

THE permanently frozen ground in Alaska's inland country where temperatures range down to −90 deg. F. had much to do with the construction plan adopted for building the Hess Creek Dam 90 miles from Fairbanks and only 40 miles from the Arctic Circle. The dam is to provide storage for placer dredging operations and, as it is only 85 ft. high with a cubical content of some 480,000 cu. yd., ordinarily no difficult construction problems would have been involved. However, unusual conditions were presented by the difficulty of access and the fact that the annual "open season" is only about 150 days and the summer thaw penetrates no more than 2 ft. into permanently frozen subsoil. Methods devised to cope with these conditions are described in the following.

As the cost of transporting freight to the site is very high, it was desirable to use a design that would call for shipping in only a minimum of equipment and material. This led to early conclusion that an earth-fill dam was the logical type. A rolled fill was believed to be inadvisable on two counts, namely, (1) in the available material there would be a large quantity of unbreakable rock fragments, ranging up to 12 or 15 in. in size, that would interfere with compaction of material placed in rolled layers. (2) The shortness of the open or working season and the normal expectancy of almost daily rain during that time which would interfere with rolled fill methods made it improbable that the fill could be completed in the time alloted to this operation.

In considering the hydraulic fill type, the critical element was the question of sufficient fines for the 16 percent of total volume required for the puddled clay core. Careful exploration by test pits showed that the needed fines could be obtained by a supplementary sluicing operation.

Test pits showed that it would be necessary to remove from the damsite frozen overburden ranging in depth up to about 40 ft. as a maximum and averaging 20 ft. This removal was necessary to get rid of roots, trees and other old vegetable matter as well as some large ice areas and to get down to frozen ground of a substantial, uniform nature. Even when a uniform formation had been reached it was found that the base on which the dam would have to be laid would consist of 31 percent moisture in frozen form.

Sprinklers vs. jets for melting

Despite the usual summer rain expectancy, the season in which the overburden was stripped provided insufficient runoff and it early became apparent that the available water would have to be used sparingly. This made doubtful the feasibility of using numerous hydraulic jets with which it had been planned to speed up stripping operations. However, jets were tried and at one time 27 were installed, reaching over the entire dam. One of these is shown in the background of Fig. 1.

In addition to using water extravagantly, the jets did not give very satisfactory results where the overburden contained so much ice. On

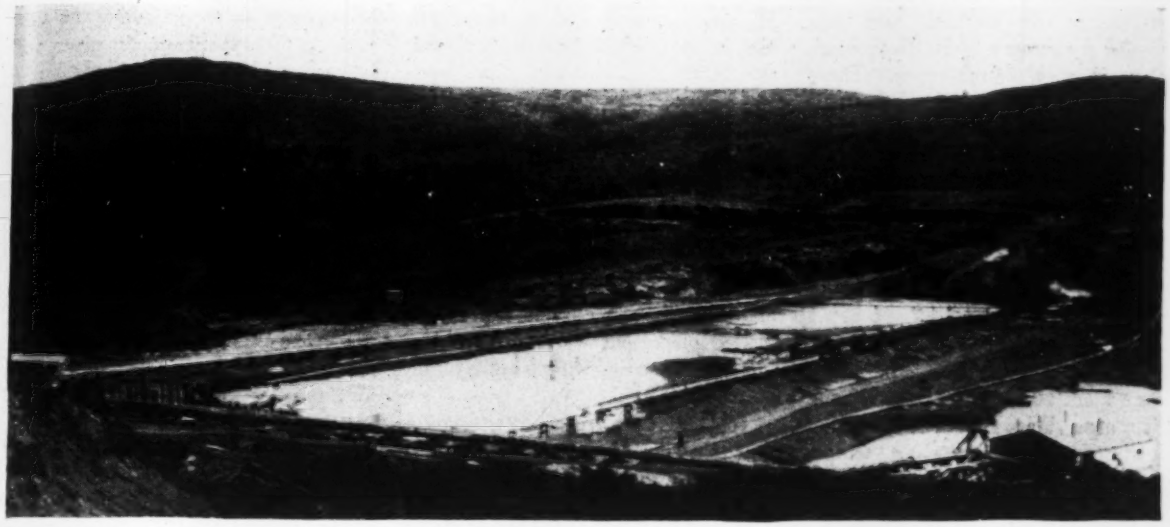


Fig. 2. Hess Creek Dam during construction, while fines were being delivered to the central pool. Pump house on floating barge and pipe supplying sluicing operations in foreground.

parts of the area the overburden was ice exclusively.

The substitution of sprinkler heads was then tried. Water for sprinkling could be delivered at 52 deg. F. and it was believed that continuous application in this way would have a substantial melting and flushing effect that would rapidly sluice away the overburden. This was, in fact, accomplished and in the areas where the sprinklers were working the surface melted off at the rate of 4 to 6 in. in 24 hours until a total of about 400,000 cu.yd. had been moved. Moreover, the resultant runoff was effective in eroding channels and conveying a large load of solids to a collection pool.

When the success of this plan had been demonstrated some 350 to 400 sprinkler heads were quickly distributed over the area to be stripped. Through these sprinklers it was possible to keep a flow of 16 to 17 sec.-ft. continually eroding the frozen surface.

Part of the plan in using the sprinklers was to recover the water used. Instead of allowing this water to waste by flowing on downstream, a large part of the muck-laden runoff from stripping operations was picked up by a 16-in. pump and forced upstream against a head of about 40 ft. Two pipe lines, each 24 in. in diameter, were laid from the dam alongside the creek channel, one on either side, 2,000 and 3,000 ft. long respectively. These discharge lines delivered to old tundra beds, a grass and moss mat some 12 to 18 in. thick, that served as excellent natural filters. The solids remained atop tundra and relatively clear water filtered into the creek bed and flowed back to the pool used as a reservoir.

Under this plan some 400,000 cu.yd. of overburden was melted down and washed off the site by the sprinkled water. About half of this was wasted down stream and about 200,000 cu.yd. was picked up by the big pump and delivered to the filtration areas. Distribution over the filter beds was made effective by shifting the ends of the discharge lines or opening holes in them at strategic points. There was no loss of water by deep percolation because of the frozen soil below. In fact, circulating the water in this way developed some increase in return flow due to the fact that the relatively warm water melted some of the underlying ice with which it came in contact.

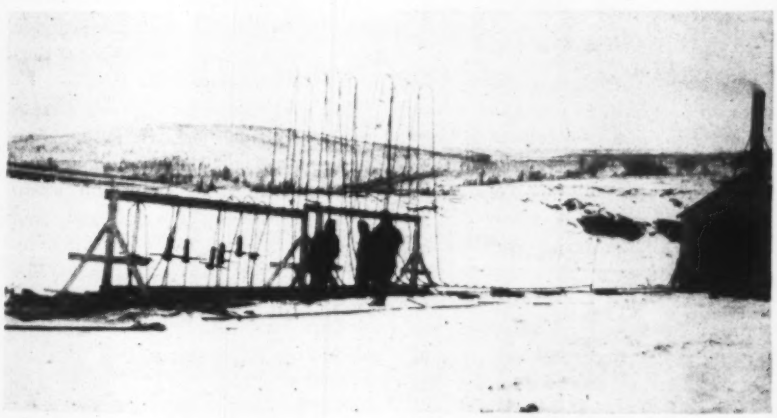


Fig. 3. The sheetpiling cutoff along the axis of the dam could be driven only after the ground had been thawed by steam pipes.

Two pumping systems

Thus closed systems were maintained by use of two pumping plants during stripping operations. One of these, making use of four 110-hp. diesels each connected to a 10-in. centrifugal pump, picked up water from the creek bed and discharged it, against a head of 175 ft., through sprinklers that were frequently shifted to the most strategic locations in the area to be stripped. The other system, operated by a single 125-hp. diesel pump, took that part of the runoff

from sprinkling operations that did not escape downstream and discharged it against a 40-ft. lift through either of two 24-in. pipes. These pipes delivered to tundra filter beds upstream whence water flowed down the natural bed to the intake of the other system. In the low pressure system delivering to the filter beds records showed an average solid content of 25 percent.

Balancing the freeze-thaw cycle

During the "open season" at the damsite atmospheric temperatures range from 70 to 90 deg. F. During this season each summer it is normal for the ground to thaw out, temporarily, to a depth of about 2 ft. Below this the ground remains permanently frozen unless disturbed. Because of these conditions it was only necessary to design a structure that would make effective use of this continually frozen subsoil.

However, an essential part of any such plan would be to see that there should not be a period during construction in which there would be risk of percolation and perhaps sliding, on a temporarily thawed plane in the lower portion of the dam. This risk was the more serious because of the puddled clay core placed by hydraulic sluicing methods in constructing the dam. If for any reason this core were slow in solidifying, a porous base would be particularly risky.

Accordingly, the design included a steel sheetpiling cutoff along the axis of the dam and a refrigeration program for use if necessary to quickly refreeze the base of the dam temporarily exposed during construction and hence thawed by the relatively higher atmospheric temperatures.

In order to get the sheetpiling down it was necessary to thaw out, by use of steam pipes, the material through which the piles were driven. Care was taken that the piledriver did not follow the steam jets too closely lest the desired resumption of frozen condition would be interfered with. The plan was to begin the driving at a time when the thawing effect of the steam had ceased and refreezing by natural effect from adjacent ice was beginning. For the most part, the steel piling was 20 ft. in length and was put down 13 ft., leaving 7 ft. projecting up into the dam.

After exposing the base on which it was desired to start constructing the fill, trenches were cut on 10-ft. centers in the surface parallel with the axis of the dam and 2-in. pipes were laid in them. These pipes were for use, if necessary, in speedily refreezing the freshly exposed base that would be naturally thawed out by atmospheric temperatures during the open season. By refreezing this zone a bond would be provided between the permanently frozen layers below and the base of the fill in which controlled placement would provide an impervious core with supports on both sides.

The toes were frozen by a method thus tried out as a test of what could be done in the larger area under the bottom of the main portion of the dam. As the toes could be frozen during the winter previous to the start of construction on the remainder of the dam, it was decided to use low atmospheric temperatures for cooling a refrigerant in "radiators" set up in an exposed location.

Two such radiators were built, one near each of the toes, consisting of a bank of 25 pipes 1½ in. in diameter and 300 ft. long. These banks were raised above ground slightly (1 to 6 ft.) so that the cold arctic air would blow across them. Both ends of these pipes terminated in headers from which the refrigerant was pumped to and through the grid of pipe laid in the toes. A crew of three men was left at the site for the 3-month period from December to March to operate pumps circulating the refrigerant. At times the temperature of the refrigerant went to —40 deg. F. Thus the main portions of the toes were satisfactorily frozen and remained so during the ensuing summer season.

A frozen dam

The toes frozen during the winter provided a reliable starting point for construction done the following season. They proved that the refrigeration scheme and methods used could be depended upon if need should arise later for refreezing the bottom zone of the dam.

This was found to be unnecessary, as was proved by readings taken on resistance thermometers in several vertical pipes left in the dam for this purpose. The bottom of the dam froze quite satisfactorily and progressive freezing has continued, indicating that ultimately nearly the entire mass can be expected to freeze solid. As time goes on these thermometer pipes will be used to check on this condition.

The hydraulic fill

Analyses of material in borrow pits from which it would be most convenient to sluice material for the hydraulic fill showed that available fines would be rather too low for the percentage of total volume required in the puddled clay core. However, it was found possible to bring in a supplemental supply that was nearly all fines by use of a separate and smaller sluicing operation. This was brought in at the opposite end of the pool from that at which the main filling operation was in progress and a very satisfactory core was carried up ranging in width from 1/6 to 1/10 the width of the dam.

The Hess Creek Dam has a length of 1,675 ft., side slopes steepening from 2.5:1 at the base to 1.3:1 at the riprapped crest, a base width of 339 ft. and a crest width of 16 ft. The spillway which is on the right bank has its crest level at El. 1083. The full reservoir will inundate some 380 acres and contain 7,700 acre-ft. Construction was begun in 1940 but was stopped by the war when the fill had been carried up to El. 1062 where a temporary spillway was put in. Completion to full height of 83 ft. above lowest stripped area was accomplished in 1946 by placing the last 27 ft. of height as a rolled fill. This method was feasible because of the small amount of work to be done and the long period during which settlement was taking place after completion of the earlier part of the work. In a 12-month period after final completion, records show that the seepage was 0.3 acre-ft. per day, only 50 percent of the amount estimated.

The structure was built for Livengood Placers, Inc., E. A. Julian, San Francisco, vice-president and general manager. W. A. Kraner, San Francisco, was in charge of design and construction of the dam and remained at the site during construction. D. C. Byer as project manager selected the location of the dam and supervised exploration and drilling operations. George E. Purser was project engineer. Chas. H. Lee, consulting engineer, San Francisco, made the soil analyses.

STUYVESANT TOWN

Rebuilding a Blighted City Area

Slum Clearance

Foundations

Erection

Buildings Completed

Thomas Airviews photo

Fig. 1. Redevelopment of a New York City slum—Stuyvesant Town in foreground and Peter Cooper Village just behind.

Where Once Were Slums

***Contents in Brief**—More than 500 structures formerly occupied the 75-acre site in the heart of New York City on which Stuyvesant Town is built. Now, there are only 35 apartment buildings, occupying one-quarter of the land. Composed of 12 and 13-story units utilizing two basic plans, the houses have structural steel frames, brick and cinder-concrete block walls, and reinforced cinder-concrete floors. In the spaces between buildings are located underground garages, a three-acre park and 12 playgrounds. Tax concessions were granted to make this a low-rent private enterprise project.*

WHAT PRIVATE CAPITAL can do to reconstruct drab, densely populated city slums is clearly demonstrated at Stuyvesant Town. Where only two years ago were 75 acres of obsolete structures in midtown New York City, there are now wholesome, sanitary quarters for about 24,000 people. Actually a city within a city, this tremendous apartment-house development was built as a low-rent project by the Metropolitan Life Insurance Co. through its subsidiary, the Stuyvesant Town Corporation.

The significance of this rehabilitation, which cost $77,000,000, can best be appreciated by comparing the new and the old Stuyvesant Town area.

When wreckers started work in the fall of 1945, over 500 structures of various types occupied the site. Boarded-up tenements, vacant stores and empty lots were common. Nowhere was there a park. According to a report of the New York City Planning Commission (May, 1943) population in the area declined from 27,000 in 1920 to about 11,000 in 1943.

While the new population is almost as large as in 1920, population density is lower than in contemporary adjacent districts. And those districts do not have the advantages of light, open areas and parks that are enjoyed by residents of the developed area.

Small percentage of land occupied

Stuyvesant Town is almost suburban in its appeal, even though it is within walking distance of midtown Manhattan shopping centers. The new buildings, housing 8,755 families, occupy only one-quarter of the land. Only 35 apartment houses replace the 500 obsolete structures. Exclusive of basements, they are 12 and 13 stories high, with some 10-story wings. In

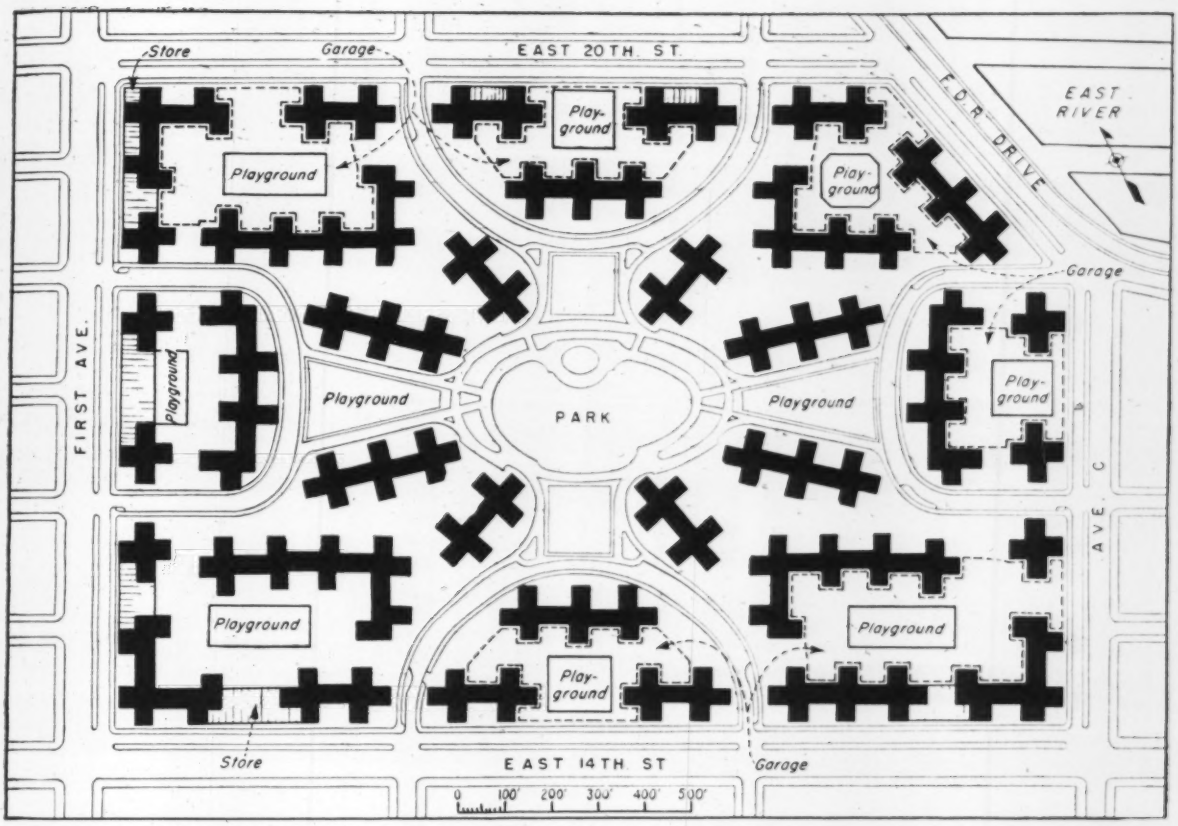


Fig. 2. Stuyvesant Town buildings are at least 60 ft. apart. Between them are playgrounds and underground garages.

addition, there are underground garages, stores, a three-acre park, gardens, and twelve playgrounds.

Tax concessions granted

To permit low rents, Stuyvesant Town was built under the Redevelopment Companies Law of New York State, a bill to encourage reconstruction of blighted city neighborhoods. A redevelopment company—the Stuyvesant Town Corp.—was organized for the purpose by the Metropolitan Life Insurance Co. Gross returns are limited to 6 percent.

So that the land could be assembled, the City of New York exercised its power of condemnation, with the corporation paying all awards. Taxes for the first 25 years will be based upon 1943 valuations, but thereafter they will be based upon the assessed valuation of Stuyvesant Town. As a consequence, the city may receive more taxes annually during the next 25 years than the decrepit properties contributed. The yield is expected to be higher because sites, such as those formerly occupied by churches, previously exempt, are now taxable and because the possibility of tax delinquency of individual parcels has been eliminated.

Metropolitan Life Insurance Co. has had previous experience in large-scale rental housing. Starting in 1924 with a project in Queens, N. Y., for 2,125 families, it continued with Parkchester in the Bronx, New York City, for 12,272 families; Parkfairfax, Alexandria, Va., for 1,684 families; Parklabrea, Los Angeles, Calif., for 1,316 families; and Parkmerced, San Francisco, for 1,687 families.

At present, the Metropolitan Life Insurance Co. has two projects under way in Manhattan in addition to Stuyvesant Town—Riverton for 1,232 families and Peter Cooper Village for 2,495 families. The latter is adjacent to Stuyvesant Town on the north (Fig. 1).

Because of the large size of these developments, considerable time and effort were expended in the study of construction details. In some cases, the solution to design problems was entirely original, but in many instances, the final selection was a refinement of the corresponding element used at Parkchester. The latter is particularly evident at Stuyvesant Town in the floor plans, heating system and many architectural details.

Grid street pattern abandoned

Stuyvesant Town represents the rehabilitation of the 18 blocks in Manhattan bounded by East 14th and East 20th Streets, First Avenue, Avenue C and Franklin D. Roosevelt (East River) Drive (Fig. 2). Streets that cut the site in a grid pattern were abolished so that the area might be developed as a unit. In return for these streets, the Stuyvesant Town Corp. conveyed to the city a strip of land around the circumference of the project for the use of local traffic.

Malls separate these one-way boundary streets from the main thoroughfares. They are paved with large granite blocks, many of which came from the abandoned streets.

Access to Stuyvesant Town is provided by four roads, each of which forms a complete loop with the local streets, on 14th St., First Ave., 20th St. and Ave. C. (Fig. 2). These loops are paved with 3 in. of sheet asphalt

on a 6-in. concrete base and have concrete curbs with concrete bases. They are directly connected to paths that circumscribe the somewhat elliptical central park.

The paths are of two types—heavy-duty and light-duty. The former are 24 ft. wide, with 6-in. thick concrete curbs. They are paved with 2-in. thick asphaltic concrete, under which is a 3-in. penetration base course and a 3-in. broken-stone foundation course. They are for fire trucks, moving vans and milk wagons.

The light-duty paths have a minimum of 8 ft. wide and are paved with one-inch thick asphaltic concrete on 4 in. of waterbound limestone screenings and 6 in. of steam cinders.

Play areas have the same type of pavement as the light-duty paths. However, the sidewalks that border the loops, are composed of 5-in. thick concrete slabs on 6 in. of cinders. Thus, paved surfaces are provided for both foot traffic and vehicles.

Basic units comprise houses

Buildings are located on the site so as to be a minimum of 60 ft. apart, permit convenient access and provide a minimum of interference with existing utilities. They are oriented to obtain a maximum of sunlight for every apartment.

Each of the houses is composed of from one to five units utilizing either of two basic plans. One, called a C-core, is cross-shaped (Fig. 3 left) and is used extensively throughout the project. The second, or F-core, is shaped like an L with an additional perpendicular wing (Fig. 3 right) and is used in a few instances to gain open space at interior angles.

In the C-core, there is a centrally located public hall containing two inclosed staircases, two elevator shafts and an incinerator flue. On a typical floor, entrances to eight apartments are spaced around the perimeter of the hall. The apartments are composed of one, two, or three bedrooms, a dining bay some 9 ft. square, a living room 12x19 ft., a bathroom about 5x7 ft., a rectangular kitchen with splayed corner, and numerous closets. Bathrooms and kitchens are located and designed to utilize minimum of floor space and plumbing.

Having the same facilities in the public hall as well as eight apartments per floor, the F-core is similar. However, the public hall is longer and narrower than in the C-core, and in three of the apartments the kitchens are fully rectangular, measuring about 8x9 ft. in plan.

The designers believe that at Stuyvesant Town there is a smaller proportion of public space to livable area than has been achieved heretofore in multiple-dwelling units. Also, they say, there is a smaller percentage of wall area to volume of space inclosed.

Fire-resistant construction used

As for building materials, in both types of units, substructures are mostly of reinforced concrete and the structural frames are of steel. Floors and roofs are of reinforced cinder concrete varying in thickness from 4 to 6 in. For ceilings, plaster was placed directly on the underside of the floor arches.

Terrazzo is used for surfacing public-hall first floors and asphalt tile for floors in public halls elsewhere. Cement surfacing is used for stair landings, wood flooring laid in mastic for living rooms and bedrooms, linoleum for kitchens and ceramic tile for baths. Roofs are waterproofed with built-up tar and gravel roofing, which is set over 1½ in. of insulation.

To meet city code requirements, structural frames are fireproofed. Exterior columns are faced on the outside with 8 in. of brick and on the interior with 2-in. thick solid cinder block. Interior columns are protected with 2-in. solid gypsum block. Beams and girders are incased in cinder concrete.

Providing openings for steel case-

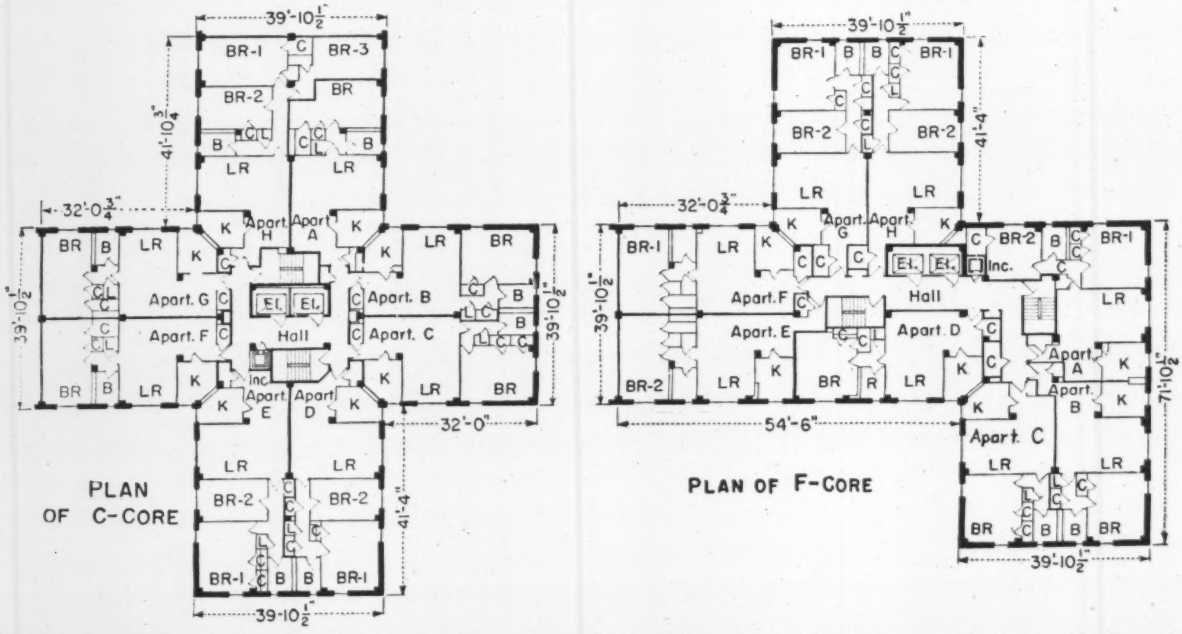


Fig. 3. A cross-shaped floor plan (left), known as a C-core, is the basic unit used most frequently in combinations to form the buildings, but in a few houses the F-core (right) is used.

Fig. 4. Exterior walls of the steel-frame buildings are faced with brick. Windows are steel casement.

ment windows, exterior walls generally consist of a 4-in. common brick facing and a back-up of 6-in. cinder-concrete block (Fig. 4). To the inside face was applied $\frac{1}{8}$ in. of damp-proofing. Between this and $\frac{3}{8}$-in.-thick gypsum wallboard, a $2\frac{3}{8}$-in. air space was left. The wallboard is coated on the air-space side with integral reflective aluminum foil and on the room side, with plaster. The heat-transfer rate of the exterior wall was computed to be basically 14.4 Btu. per sq. ft. per hr., with corrections to be applied according to the exposure.

Interior partitions between units and between apartments are composed of 3-in. hollow gypsum block, plastered two sides. This construction is also used in the public halls. Within apartments, partitions are formed by plastering gypsum wallboard to a total thickness of about 2 in. except at bathrooms and between kitchens, where two partitions, each made of plastered gypsum wallboard, are used. Bathrooms also have a tile wainscot.

Elevator shaft inclosures are composed of 6-in. hollow gypsum block (two cells thick), plastered on the hall side only. Vent shafts are inclosed with 3-in. solid gypsum block and stairs with 4-in. hollow gypsum block, plastered on two sides.

Vertical transportation

An easily erected, lightweight all-steel stair was especially designed for this installation. Individual tread and riser sections, each fabricated from one piece of checkered floor-plate, are bolted to clip angles on stringers. Since the checker pattern provides a safe grip on the complete surface of the tread, separate nosing pieces were not needed. The stringers, made of 10-in., 6.5-lb. junior channels, are fastened to the structural frame of the building.

For most of the vertical travel in the buildings, elevators rather than stairs will be used. A total of 178 elevators is being installed by the Westinghouse Electric Corp. Grouped in pairs in each core, fully automatic, with two-button selective controls, they have a capacity of 2,000 lb. and will travel at 250 ft. per min. Passenger cabs are made of steel coated with a hard-finish, flexible, vitreous enamel.

Smooth operation is provided by variable voltage drive. Elevator machines are of the worm-gear type, with the gear-housing supplying the support for the main shaft and brakes. A brake switch in the electrical circuit and a short-stroke brake plunger insure instantaneous braking and smooth stops.

Garages placed underground

Elevators and stairs terminate at levels where access is provided to the roof or to the street or terrace. No provision has been made for direct access from the buildings to the six underground concrete garages, which are located between the buildings. One-story high, with a total capacity of about 1,700 passenger cars, the garages have automobile entrances fronting on streets and pedestrian exits adjacent to the houses.

Garage doors, 8 ft. high and from 10 to 20 ft. long, were built and installed by the Kinnear Manufacturing Co. Designed to open upward, they are composed of 18-in. sections of 16-ga. hot-dip galvanized steel; a counterbalance consisting of a compact arrangement of oil-tempered torsion springs on a solid steel shaft; a heavy plow-steel cable connecting this shaft and door bottom and operating over ball-bearing sleeves and scored drums; and a steel track assembly mounted on the jamb by means of a continous steel angle. This angle also provides a smooth, flat sealing surface on the jamb against which the door closes. Controlled by pushbuttons, motors open or close the doors at a rate of $\frac{3}{4}$ ft. per min. Automatic chain operation is provided in case of power failure.

In addition to the apartment buildings and garages, other structures in Stuyvesant Town include one-story-and-basement stores, which are located between houses on 14th St., 20th St. and First Ave. Occupying a depth of about 80 ft. and a total frontage of close to 1,000 ft., they are separated from contiguous apartments by fireproof partitions and slabs.

In accompanying articles, further details are given on structural design, foundations, building erection and utilities at Stuyvesant Town.

Building a Skyscraper City

PLANNING AND BUILDING the thirty-five 12 and 13-story apartment houses at Stuyvesant Town in New York City was a complex job of considerable magnitude. Total cost of the project, constructed near mid-town Manhattan, is about $77,000,000, to provide homes for some 21,000 persons.

Broad planning was directed for Metropolitan Life Insurance Co. by a Board of Design of specialists on the different phases of the work. Engineering consultants to the board, named in the accompanying table, handled important parts of the design and supervision of construction. Building was done by Starrett Bros. & Eken who worked closely with the planners and with 86 contractors to coordinate all phases of the work.

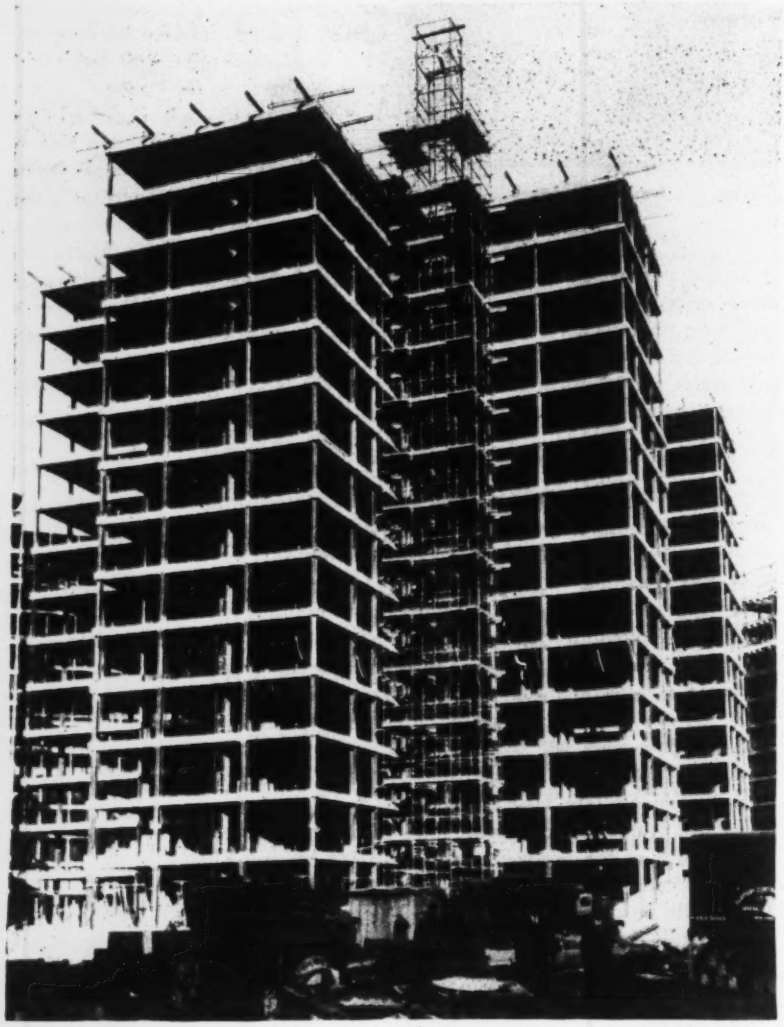
This close coordination of planning and of men, materials and machines was the key to construction success. Management headed up in the centrally located job office of J. H. Griffiths the builders superintendent. Each of the principal contractors maintained a field office nearby. Many of the contractors had sub-contractors and each depended on numberless jobbers and manufacturers for on-time delivery of thousands of items.

Workmen for the huge job came from the several craft unions affiliated with the American Federation of Labor and were sent to the job through the union locals. Wages as well as working hours and conditions were fixed by area-wide agreements between the Building Trades Council of the AFL and the Building Trades Employers Association.

Short on skilled help

Work generally was on one shift, which varied from 6 to 8 hr. per day depending on the craft. An attempt a year ago to equalize this condition in New York City so that all crafts worked the same hours was not successful. Some overtime work has been inevitable, but it was kept to a minimum to minimize labor cost.

There was some shortage of labor —particularly bricklayers, plasterers, and other skilled crafts to which admission is severely restricted by union locals. Helpers and laborers gener-



Tower hoists were set up as soon as the steel was erected and used by all trades for hoisting needed materials.

WORKER FORCES AT STUYVESANT TOWN ON A TYPICAL "GOOD" DAY IN SEPTEMBER 1947.*

	Starrett Bros. & Eken	Other contractors
Supervisory	39	73
Auditing, tpk., materials	136	17
Engineering	53	8
Watchmen	62	35
Carpentry	541	16
Masonry	99	...
Concrete, mix. and placing	739	56
Bricklaying	1,443	2
Plastering	46	470
Iron workers	22	181
Hoisting engineers	68	22
Excavation	149	33
Lathers, rod placers	105	207
Painters, glaziers	...	96
Plumbers	...	256
Steamfitters	...	166
Sheetmetal workers	...	32
Waterproofers	...	25
Roofers	...	23
Tile setters	...	32
Flooring	...	50
Electrical	...	194
Elevator erection	...	56
	3,462	2,050

* Some work, such as excavation, was operating at far less than full force at this time. Maximum force was about 5,800.

ally were available as needed and now are in excess of the demand. Some work stoppage resulted from labor disputes—notably a general trucking strike with respect to which the job was an innocent, but severely injured, bystander.

There were two major problems with materials—getting them to the job when needed and storing them on the job when they came in long ahead of requirements. Much material was stored in the huge garages, which were completed early in the construction. Large Quonset type huts also were used. Best and most used space for storage, however, was in the buildings themselves where material not requiring complete protection was stored near the point of installation.

Building Stuyvesant Town included construction of streets, roads, stores and the other facilities needed for a modern community.

PLANNERS AND BUILDERS OF STUYVESANT TOWN

Owner—Metropolitan Life Insurance Co.

Board of Design—Gilmore D. Clark, chairman, Irwin Clavan, architect, H. F. Richardson—George Gove and Andrew J. Eken.

Engineering Consultants—J. Di Stasio on structural design; Clarke, Rapuano and Holleran on site plan, site development and utilities; and Meyer, Strong and Jones on heating, ventilating, plumbing, electrical work and elevators.

Special Consultants—Henry V. Spurr, Charles Scott Landers, Spencer, White and Prentis, Inc.; on structural steel, F. H. Frankland.

Builders—Starrett Bros & Eken, Inc.—with 86 contractors—J. H. Griffiths in charge.

Principal Construction Contractors working under the direction of the builders, Starrett Bros & Eken, Inc.

Job	Contractor	In Charge
Wrecking	John E. Smith, Inc.; Wreckers and Excavators, Inc.; Lipsett Steel Products Co.	John E. Smith
Excavation	Slattery Contracting Co	George Benisch
Piledriving	Western Concrete Pile Co	Harry Larson
Concrete	Colonial Sand & Stone Co	P. Areamone
Foundations and garages	Arthur A. Johnson Corp	H. L. Schmeckpeper
Concrete testing	E. L. Conwell & Co	John W. Slawson
Structural frame	Bethlehem Steel Co	John Stuart
Steel inspection	Fred De P. Hone Co	J. L. McDowell
Stairs	Sexauer & Lempke	Wm. Sexauer
Window frames	Truscon Steel Co	Wm. Hunt
Materials hoists	Chesebro, Whitman Co.	F. N. Faulkner
Bricklayer scaffolds	Patent Scaffolding Co	S. Artino
Partitions and plastering	Neff Lathing & Plastering Co	Fred Dill
Heating	Baker Smith & Co	George Devine
Plumbing	J. L. Murphy, Inc	Chas. Ruppert
Electric	L. K. Comstock & Co	L. Dieringer
Elevators	Westinghouse Electric Corp	B. K. Strader
Floors, asphalt tile	Circle Floor Co	C. D. Greenwald
Floors, wood	John T. Swanson Co	J. T. Swanson
Bath tiling	Lieber & Nobbe, Inc	Allan Chester
Painting	Hudson Painting & Decorating Co	Saul Brodsky
Bucks & doors	United Metal Div., Diebold, Inc	Robert Trainer
Street paving	John Meehan & Sons	John Meehan
Landscaping	Roman Landscape Contracting Co., Inc	John Hoffer

Concrete for the job was bought under a single contract for delivery as required by the different users. It was batched into transit-mix trucks at nearby commercial plants and mixed on the job where water content and mixing time could be checked. Concrete was specified on a controlled-strength basis. Brick mortar also was purchased from a central mix plant and delivered ready to use.

Starrett Bros. & Eken supplied utilities services such as light and water for the construction. Materials generally were supplied by the contractors placing them.

How Stuyvesant was built

As with most construction, everything needed to be done at once. Wrecking and clearing started simultaneously with finding homes for the displaced residents of the site. Excavation, pile driving and foundations started almost at the same time. Steel was ready to go up before there was a place to put it. And, going on in the midst of all this activity, was the job of removing, relocating, rebuilding and restoring of utilities—gas, electric, telephone, steam, water and sewers—for a city of 24,000.

How each of the several construction jobs was accomplished is told in the following articles.

Fig. 1. Structural frames of the Stuyvesant Town buildings utilize 20 percent less steel than usually specified

Stuyvesant Town Framing Saves Steel

ECONOMY in the structural design of Stuyvesant Town buildings was achieved through painstaking studies of alternative plans. The final design calls for field-bolted structural steel frames, cinder-concrete floor arches and brick and cinder-concrete block exterior walls. Weight of steel averages about 8.6 psf., as compared with the 11 psf. usually employed for steel-frame multi-story apartment houses.

Stuyvesant Town is a low-rent housing project built at a cost of about $77,000,000 by the Metropolitan Life Insurance Co. in New York City. Each of the 35 buildings is composed of from one to five units of 12 or 13-story height and of either of two basic plans. A so-called C-core type of unit is cross-shaped, with an overall length of about 120 ft. and width of 104 ft. An F-core, shaped like an L with an additional perpendicular wing, has an over-all length and width of about 110 ft. (Fig. 3, p. 76). In both units, wings are 40 ft. wide.

Design was in accordance with the building code of New York City. Thus, the allowable bending stress in structural steel is 18,000 psi. and the minimum 28-day compressive strength of cinder concrete permitted is 700 psi. However, for the floor and roof arches, which are composed of wire-mesh reinforced, 1:2:5 cinder concrete weighing 108 lb. per cu.ft., a strength of 800 psi. was specified.

Thickness of slab was determined by the following code formula:

$$t = \frac{L}{2} + \frac{w - 75}{200}$$

where t is the thickness in inches, L the clear span in feet between steel flanges and w the gross uniform load in psf. Minimum thickness is limited to 4 in., which may be used for spans up to 8 ft. But even for thicker slabs, the clear span between steel flanges is not permitted to exceed 10 ft.

Area of reinforcement, A_s, in square inches per foot of width of slab is given by the following code formula, which is used in conjunction with the thickness equation:

$$A_s = \frac{wL^2}{3C}$$

The factor C was taken as 26,000 for the wire mesh used.

As an example of the use of these formulas, assume a total load of 125 psf. and a clear span of 8.50 ft. Then, the required thickness is 8.5/2 plus (125 — 75)/200, or 4.50 in., and the needed mesh area is $125 \times (8.5)^2 \div 3 \times 26{,}000$, or 0.116 sq. in. per ft. Should a deeper slab be used than specified by the formula, the amount of steel may be decreased proportionately. For example, if in the case considered, a 5-in. slab be used, then the area of mesh required is $0.116 \times (4.5 - 1)/(5 - 1)$, or 0.101 sq. in. per ft.

Cinder-concrete floor and roof slabs at Stuyvesant Town vary in thickness from 4 to 6 in., depending upon the span and load. Generally, live loads were taken as 40 psf.

Spacing of structural members

Since the clear span of the cinder-concrete arches was limited to 10 ft., the maximum spacing of supporting steel beams was fixed by the decision to use this type of floor. In determining the location of the beams, preference was given to framing along the center lines of columns to simplify connections and minimize eccentricities. Generally, beams were located at or near partitions (Fig. 2). In some cases, to limit the span of a slab to 10 ft., it was necessary to cantilever channels from a column to

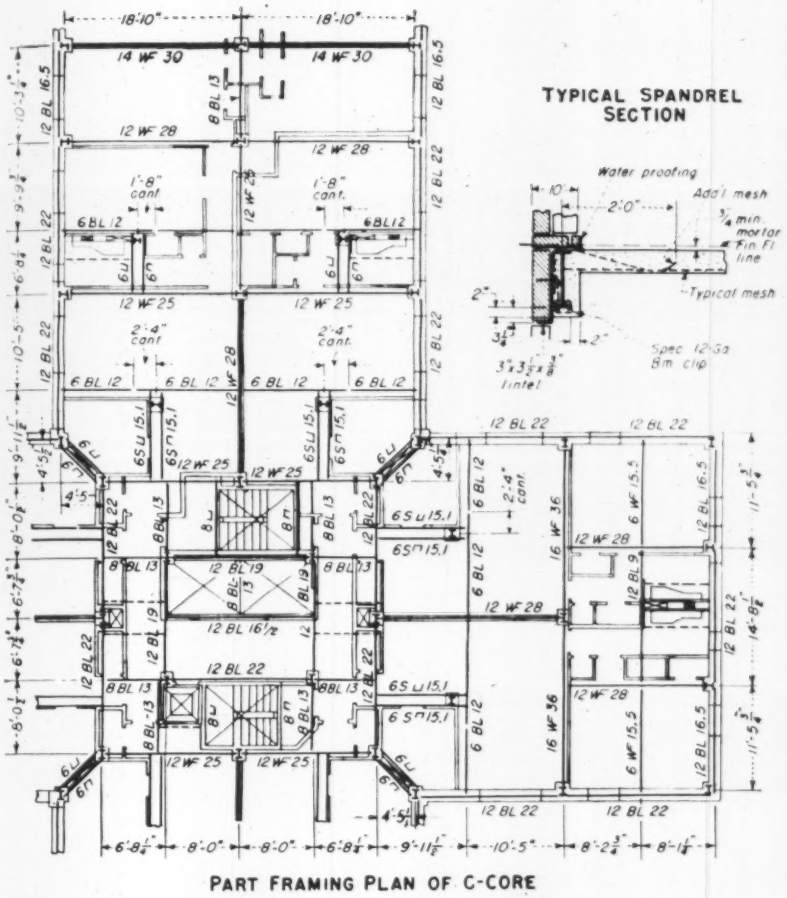


Fig. 2. Duplication of structural members and details, framing of beams along column centerlines, where possible, and elimination of secondary steel beams contributed to the economy of the design.

carry a supporting beam. Columns were generally located so that the 2-in. thick gypsum-block fireproofing was flush with one face of a partition.

Secondary steel header and trimmer beams at vents and other openings were eliminated by deepening the slab and adding reinforcing bars adjacent to the openings.

Considerable repetition of floor members was possible. One reason was that floor plans were standardized. Each building is composed of one or more units with only two different plans for typical floors. A second reason was that the wings of these units were laid out in duplicate where possible, and furthermore, some beams were repeated in each wing. Also, attention was given to reproduction of connection details, made possible by the simple grid, central framing.

Economies effected in the design of spandrel beams are noteworthy. The wall these members support consists of 4 in. of brick and 6 in. of cinder-concrete block, plus furring and plaster. Studies indicated that a 12-in. light beam used throughout the project would result in savings affecting the steel frame, masonry, waterproofing, fireproofing and other details. Therefore, this type of beam was generally selected and one type of connection detail was used with it.

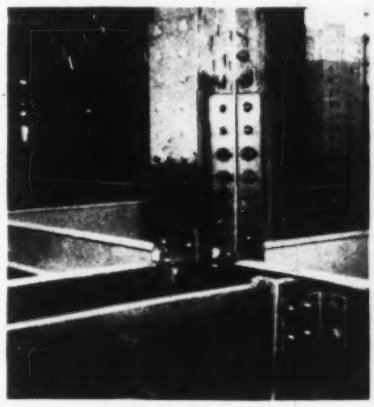


Fig. 3. Field connections were generally bolted. Top and bottom seat angles on the column flanges were shop riveted.

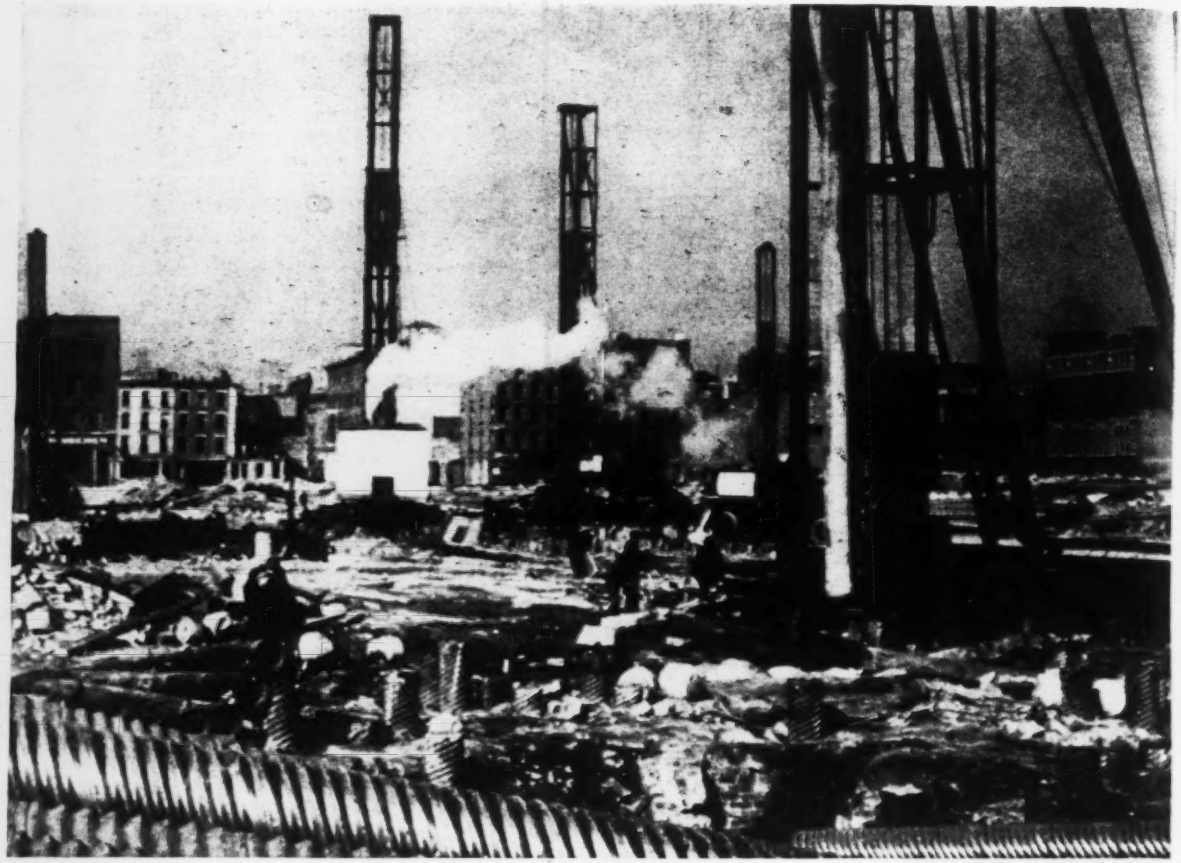
Field connections bolted

Another element contributing to the economy of the design was the shape of the basic units comprising the buildings, which made field bolting of connections possible. Under the New York City building code, rectangular steel structures less than 125 ft. high may be bolted providing the height is less than 2½ times the minimum horizontal dimension. The Stuyvesant Town buildings are composed of cross or L-shaped cores of superior ability to resist wind forces, even though wings are only 40 ft. wide and as much as 118 ft. high. Therefore, a field bolting option could be selected.

Field connections subject to wind stresses and field splices of water-tank and elevator columns were made with special snug-fitting, unfinished bolts. Field connections of beams carrying elevator machinery were first bolted to facilitate erection and then welded as a safeguard against possible vibration due to operation of the elevators. All other field connections and splices were made with ordinary unfinished bolts (Fig. 3). Column splices generally were located 18 in. above the floor, and the bolt holes did not necessitate increasing critical column sections. To prevent bearing on the threads, a washer was placed under every nut, and for ease of erection, a toothed washer was inserted under each bolt head, permitting the nut to be tightened by one man.

Shop connections were riveted. These included the top and bottom seat angles attached to column flanges for supporting the beams. To maintain duplicate details for similar beams at different floor levels, these seat angles were lengthened and thickened with reduction in column size from story to story.

It is obvious from this brief description that, in a project of this magnitude, with considerable duplication of architectural layout, even a fractional saving in any structural item would result in large savings for the job as a whole. In examining the design, this fact should be kept in mind.



Western Concrete Pile Co. Photo

Fig. 1. Five of the seven drivers used to put down the 42,000 piles needed for support of the Stuyvesant Town buildings.

Fitting Foundations to Variable Ground

***Contents in Brief**—Stuyvesant Town buildings are on spread footings, piles or a combination of both. Button-bottom piles driven to considerable penetration in water-bearing sand strata sometimes showed only moderate resistance. Tested after the soil re-formed around the stem the piles were found to have high bearing value. Driving data on penetration of the piles into bearing strata and blows applied primarily to the pile bottom were developed from tests on groups of piles into criteria for safe permanent friction bearing. This article is based on extensive reports on the pile foundations at Stuyvesant Town prepared by Henry V. Spurr, formerly vice-president of Starrett Bros. & Eken, Inc. and by Joseph DiStasio, consulting engineer on the project.*

MIXED STRATA under the site of Stuyvesant Town demanded careful investigation of bearing ability and a variety of supports for the 35 tall buildings and several smaller ones in the project. Some structures are on piles, some are on spread footings while some are on both.

Some piles were driven to satisfactory end-bearing resistance; others went to considerable depths without reaching suitable bearing as determined by driving formula. In the latter case extensive tests proved that dependable friction values gradually developed around the pile stems of footing groups after driving. As a result, new criteria were evolved to evaluate this available friction bearing from the record of hammer blows.

The Stuyvesant Town location is the old "gas-house" district of Manhattan, the area between 14th and 20th streets and from First Ave. eastward three blocks to East River Drive. Originally this site was largely an open cove in the tidal estuary of the East River. From time to time new bulkhead lines were established and ground reclaimed by filling in. At such times tidal eddies changed, resulting in an irregular pattern of

sedimentation from the tidal scour.

The site has been covered in the past by tenement houses, apartment buildings, factories, stores and large gas-holders. It is an area that has been built upon, wrecked and rebuilt upon. Old foundations have been buried and new ones installed. Timber grillages, barges, wharves and even gas holder foundations filled with riprap were encountered in excavating and pile driving.

Spread footings on good soil

A "knoll" area of primary soil in the 14th St. and First Ave. corner of the Stuyvesant site was sufficiently firm to support heavy structures on spread footings. Over the rest of the site good material dipped sharply to a lower level and is overlaid by secondary deposits in the old river-bed area. The secondary deposit includes the debris described above, coarse sand and gravel beds and sedimentary silty sands. Under the old river bed there is coarse-to-fine silty or micaceous sands with mixtures of clays, then coarse sands, deteriorated rock and finally ledge rock of Manhattan schist or gneiss.

Spread footings were used to support three of the 12 and 13 story buildings and for major portions of three other high buildings. A supporting value of 3 tons per sq. ft. was used for the knoll area.

Buildings partly on piles and partly on spread footing had a transition area between two types of footings. The soil pressure used in the main spread-footing area was gradually decreased, usually in three steps of $2\frac{1}{2}$, 2 and $1\frac{1}{2}$ tons. Thus the unit bearing pressure for the spread footing adjacent to pile footings was one-half the value for the general spread footing design.

Cast-in-place concrete piles

Most of the buildings were on piles, a total of 42,522 cast-in-place concrete piles being driven on the Stuyvesant project. These supported 29 of the thirty-five 12 and 13 story buildings, plus part of three other main buildings, six large parking garages and some of the stores.

A hard crust overlying some 10 to 20 ft. of soft secondary deposits then firmer material of varied character for the full depth of driving

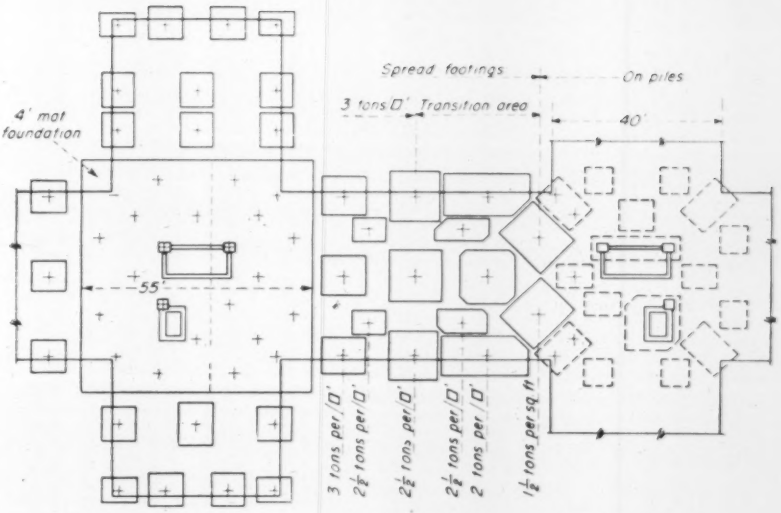


Fig. 2. Complex foundation under one of the 13 story buildings. Good strata at left are loaded to 3 tons per sq. ft., reducing to 1½ tons as the strata dips to a level that requires piles for bearing. To support closely spaced columns under a roof tower a mat footing was used.

prompted selection of the button-bottom type pile. A precast concrete "button" 17-in. of outside diameter was driven with a heavy-walled 14-in. o.d. steel-pipe casing. Upon completion of driving of the casing a 12-in. dia. water-tight corrugated steel shell was inserted to bear on the button

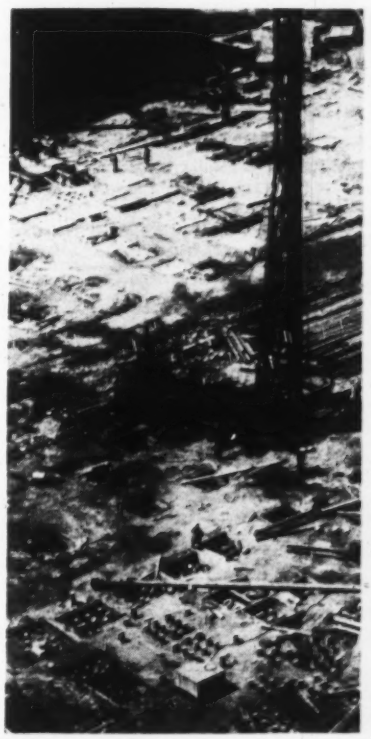


Fig. 3. Pile tops generally were close to plan location despite hard driving.

bottom, to which it automatically attached itself by a spring clip. The pile was completed by filling the spiral corrugated shell with concrete, after the casing was withdrawn from the ground.

The shape of the button head, with a sloped top shoulder, holds the secret of unreinforced concrete successfully withstanding hard driving. A heavy ring at the bottom of the steel driving casing bears only on the sloped shoulder, keeping all the concrete of the point always in compression.

Piles for 30-ton loading

Where there was a hard crust on the ground the pipe casing was driven open-end for about 2 ft., then withdrawn and the earth removed from it. These starting holes helped to keep the pile in plan location at the surface. Otherwise, the precast head was driven even through dumped rock fill or lean concrete without spudding or other costly penetrating devices.

Piles generally were designed for 30 ton loading with bearing pressure computed by the New York City code or the *Engineering News* formula. Some piles developed satisfactory end-bearing resistance of the precast button head on the upper part of the sand stratum just under the soft material. But many times the blows of the hammer per foot of penetration of the pile in driving the head did not indicate a safe bearing resistance

of 30 tons per pile. Such piles were developed and tested as friction-type piles.

It should be noted that the driving was done on the button head alone, which made a hole 3 in. larger than the following casing. Thus, the driving resistance was essentially the end-bearing of the pile head alone.

Tests conducted at Stuyvesant Town and at Riverton, a companion Metropolitan housing project where subsurface conditions were similar, verified the known phenomenon that soil shearing or frictional resistance would build up around the pile in water-bearing sands. This was true even though the pile or pile shell was dropped in a hole of larger diameter than the shell itself.

Driving resistance of the precast button head alone in soils offering frictional resistance obviously was not indicative of the total resistance of load-bearing capacity of the pile unit plus the stem. Where the pile units had to be considered as a friction type, the piles were evaluated under a section of the New York City code providing for pile loadings proved by bearing tests.

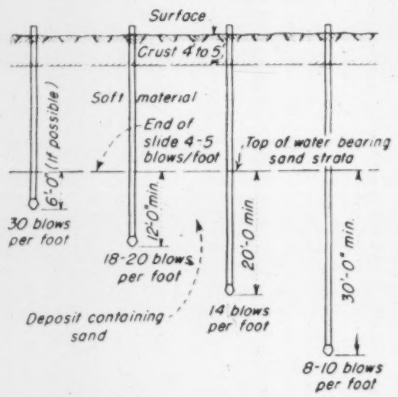


Fig. 4. From load tests on piles driven to varying penetration in bearing strata at Stuyvesant the minimum hammer blows needed on the button point to give 30 ton bearing were determined.

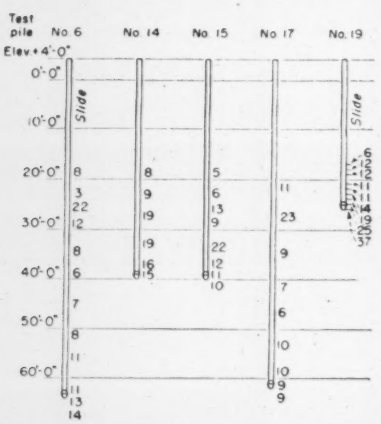


Fig. 5. Five piles in the same locality were driven to about the minimums permitted under the "directive." Figures show typical number of blows per foot.

Piles proved by test loads

To determine this friction support, possibly the greatest program of testing piles and study of driving data ever made was undertaken. The objective was to arrive at a dependable criterion for minimum driving that would produce a safe permanent bearing of 30 tons per pile. The New York City Department of Housing and Buildings cooperated in setting up the test program and in recording and evaluating the results.

To meet New York City code requirements, piles may not have a final settlement, less rebound, of more than 0.01 in. per ton of load. Thus for a 30-ton pile, plus the specified 50 percent overload for testing, maximum permissible settlement was 0.45 in. (about $\frac{7}{16}$) or 0.0375 ft. Of utmost importance were tests made on groups of four to nine piles to demonstrate the bearing capacity of a footing unit rather than of individual piles. An unusual result of testing of individual friction piles in a group and then the entire group was that—under conditions at Stuyvesant Town—the total bearing ability of the group was close to a summation of the capacity of individual piles.

Numerous tests on driven piles proved that penetrations of as much as 30 ft. into the deposit containing sand would withstand the 45-ton test load despite a driving resistance of the button point for the last foot of only 8 to 10 blows of a 5,000-lb. ram falling 3 ft. (a No. 1 Vulcan single-acting hammer).

As a result of many successful pile bearing tests a "directive" was issued outlining the basis for determining the satisfactory bearing capacity of piles in which end-bearing support was not reached and the soil friction developed the support.

Directive for driving

To assure that piles reached the water-bearing sand strata in all locations, site maps were provided for field men showing top of sand and elevation of rock at each building. Elevation of the top of sand strata ordinarily was verified by behavior of the driving ram. At the start, driving was hard in the crust, then there was a "slide" of 10 to 20 ft. in softer material until top of the sand was reached where driving was again necessary. Evaluation of piles for bearing was based on the resistance to driving below the slide. Briefly, for a minimum penetration of 12 ft. into water-bearing sand deposits, 18 to 20 blows with a 15,000-ft.-lb. ham-

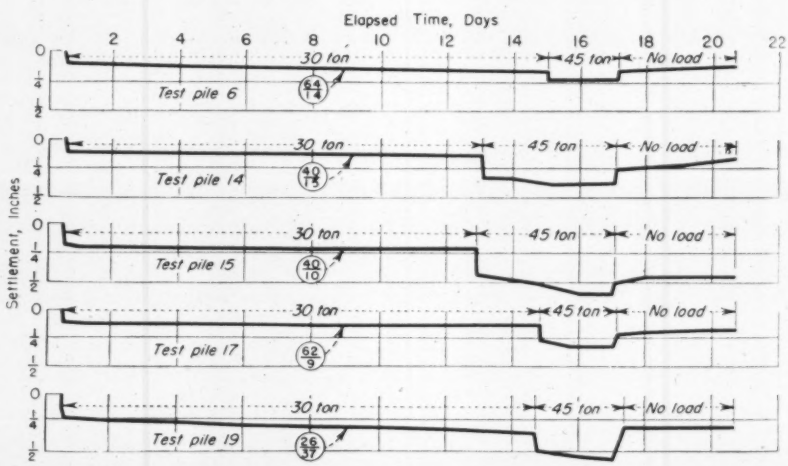
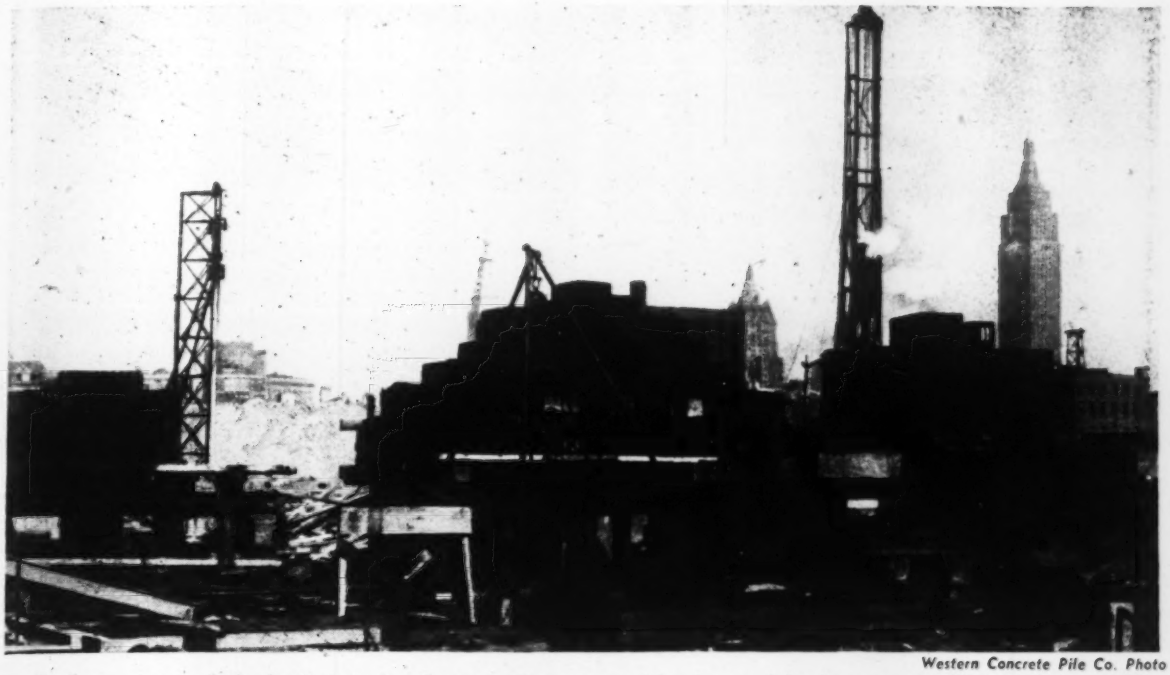


Fig. 6. Test records of the five piles shown in Fig. 5. Pile 15 was driven to less than the directive requirement and settled a little more than the permissible 7/16 in. Pile 19, driven to end-bearing at 37 blows for the last foot, but at shallow depth, settled almost as much.



Western Concrete Pile Co. Photo

Fig. 7. Tests were made by loading single piles or footing groups with caisson weights in an amount 50 percent or more over the design load. For the conditions and soil at Stuyvesant Town a pile group carried the 45-ton per pile test load with about the same settlement as for single piles.

mer were specified: for 20 ft., 14 blows; and for 30 ft., 8 to 10 blows were required. Fig. 4.

Issuance of the "directive" stimulated rather than ended the program of tests and bearing capacity studies. One of the most significant of the many tests made was that on five single piles in Building 33 at Stuyvesant Town. These piles were driven to varying depths in the deposit containing sand but each was given about the minimum number of blows permitted by the directive at the penetration attained.

The driving and test record of these piles is shown graphically in Fig. 5 and 6. Tests were started six to eight weeks after installations. One of the piles tested, No. 15, was driven to less than the minimum of the directive; it will be noted that No. 15 showed slightly more permanent settlement than the 0.0375 ft. permissible under the New York City code and it was not used as a permanent pile. These and other tests indicated that the "directive" specified about the permissible minimums. But, generally, bearing values shown by driving data were well above the minimums discussed here.

Typical of test results on footings with deeply driven piles is that shown in Fig. 8. Five 60 ft. long piles in a footing averaged 11 blows for the last foot of driving. Tested a month after driving, the piles showed only $\frac{3}{8}$ in. settlement and a rebound to $\frac{1}{4}$ in.

Proof of the increase in bearing value of the piles as the soil re-formed around the stem was shown by a "re-drive" test on a four-pile group. Piles 40 ft. long were driven with a 5,000-lb. hammer to a resistance of 14 blows per foot at 20 ft. penetration into the bearing strata. A few weeks later these piles were re-driven with the same hammer. (For purposes of identification this operation was classed as a re-drive test, although the piles as installed to carry loads were driven for the first time.)

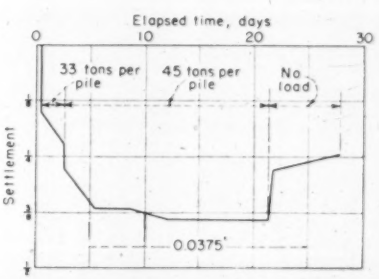


Fig. 8. Test results on a footing in which the five piles penetrated about 40 ft. into the bearing strata but driving stopped at 11 blows per foot.

For each of three of the piles 50 blows achieved a penetration of less than 5 in. On the fourth pile 80 blows were required for 5-in. penetration. A comparison of the resistance to further driving with the original record of 14 blows per foot indicates the effectiveness of the corrugated shaft of the pile to carry loads.

Driving in mixed material

Special methods were used where rock displaced in driving adjacent piles might puncture the thin corrugated shell. A 10¾-in. O.D. pipe was dropped inside the shell as soon as the shell was placed and left until driving in the immediate area was completed. The pipe was removed prior to filling the shell with concrete.

In one area six old gas-holder foundations were encountered, several of them with 16 ft. of dumped large rock below the excavation line. The button points were driven through the rock debris, some 16 in. of lean concrete and on to refusal in coarse sand using a 7,500-lb ram hammer. Very few of the concrete points were broken and the difficult driving was accomplished with little delay.

All of the pile driving, and field work on the pile tests, was done by the Western Concrete Pile Co.

Fig. 1. One-story garages occupy the space between some buildings and carry a 4-ft. earth fill to serve as open courts.

Concreting Large Volumes in Small Pours

FORMING and placing 100,000 cu. yd. of scattered concrete for pile caps, footings, basement walls and garages at Stuyvesant Town was in itself a major construction job. Carried out by the Arthur A. Johnson Corp. under a fixed-price contract, the work touched all of the thirty-five 12- and 13-story buildings in the New York City development as well as the six one-story underground garages that serve it. About a fourth of the structures rest on spread footings, the rest are on piles.

Footings and pile caps were formed with plywood-faced, steel frame unit panels made in 2-ft. widths and in multiples of 2 ft. lengths. With "specials" 3 ft. 6 in. wide and up to 5 ft. 2 in. long, the panel forms could be made adaptable to any use. Pile cap and footing form corners were held by heavy vertical angles, and the sides kept to line by 4x8 timbers. The timbers were tied only at the corners, thus avoiding interior rods.

Although these same unit panels were used to form the 13-in. thick concrete foundation walls of both buildings and garages, some as much as 26 ft. high, all-steel sections were adopted for the pilasters in the building walls. These forms were tied at 2 ft. centers each way by prepared ties. Small timbers were used for vertical alignment of the forms and were attached with a wire clip tightened with a wedge.

Concrete was delivered where needed by transit-mix trucks. It was chuted directly to footing forms where they could be reached, and elsewhere was placed by buggies or cranes.

Flat-slab roofs support play areas

Garages for the project were planned to utilize the open space between the buildings: their roofs, at first floor level, were used as the common court and playground of a group of buildings. To permit planting of trees and shrubs the roof carries 4 ft. of earth besides curbs, pavement and the like and is designed for a live load of 100 psf. in addition, a total including its own weight of 700 psf.

The area occupied by the garages was made quite irregular by the cross-shape of the apartment buildings. Column spacing was made even more irregular by aisle and clear space requirements of a garage. Columns varied from 27 ft. to as little as 14 ft. centers in adjacent bays so the roof was designed as a flat slab, using a thickness of 13½ in. Round columns were used to secure greatest efficiency of the member with the least concrete. The round shape was especially desirable for the garages as there are no corners for motorists to knock off. As previously stated the walls are 13 in. thick. The extent of one of the garages is shown in Fig. 1.

Separate grade-beam type walls

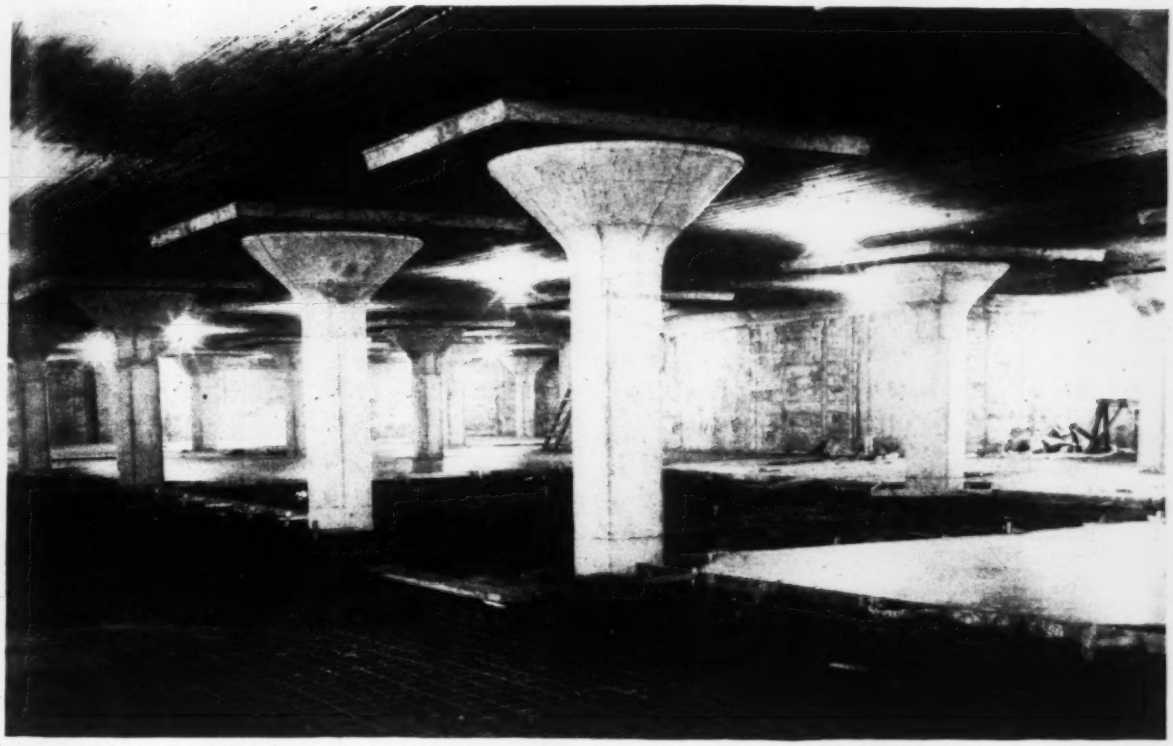


Fig. 2. Pile-supported columns with 6-ft. dia. capitals and 19-in. deep drop panels carry the 13½-in. thick roof slab of each garage. The mesh reinforced garage floor rests on the ground.

were used for the buildings and the garages, with a 2-in. space left between the walls for expansion. Garage walls were concreted first and stripped, then 2 in. of bituminous material attached by pushing it over the protruding ends of the form ties. Adjacent walls for the buildings then required only one wall form, which was held by ties inserted in coarse-thread screw anchors previously embedded in the garage wall.

Columns of 26 or 30 in. dia., with their tops flared to 6 ft. were poured in metal forms. The columns merged into the slab in a 19-in. thick drop panel that varied in size from 8 ft. to 9 ft. 8 in. square to meet the design requirements of different column spacing. A frame was set up to hold the column form and the drop-panel section of the slab. Supports for the latter as well as for the 13½-in. roof slabs were posted up from the ground to carry the metal and plywood unit panels, large plywood sheets or T.&G. sheathing made up in 2 ft. x 10 ft. panels.

Fig. 3. Large panels of plywood-faced, steel-frame forms were used for footing and walls. Footing form corners were held by heavy vertical angles.

Columns and roof slabs of the garages were concreted together, requiring 21,400 cu.yd. of concrete and 477,000 sq. ft. of forms. Columns were filled first so that initial shrinkage could occur before concrete for the slab was placed. Where a crane could reach the concrete it was transferred directly from truck mixers to the slab. Otherwise, the concrete was hoisted by crane and wheeled to place in buggies.

The garage roof slab is enveloped by membrane waterproofing carried up the sides of parapets or adjacent apartment building walls. On top of the waterproofing a 2-in. thick protective mortar coating was placed, over which earthfills and landscaped court areas were constructed.

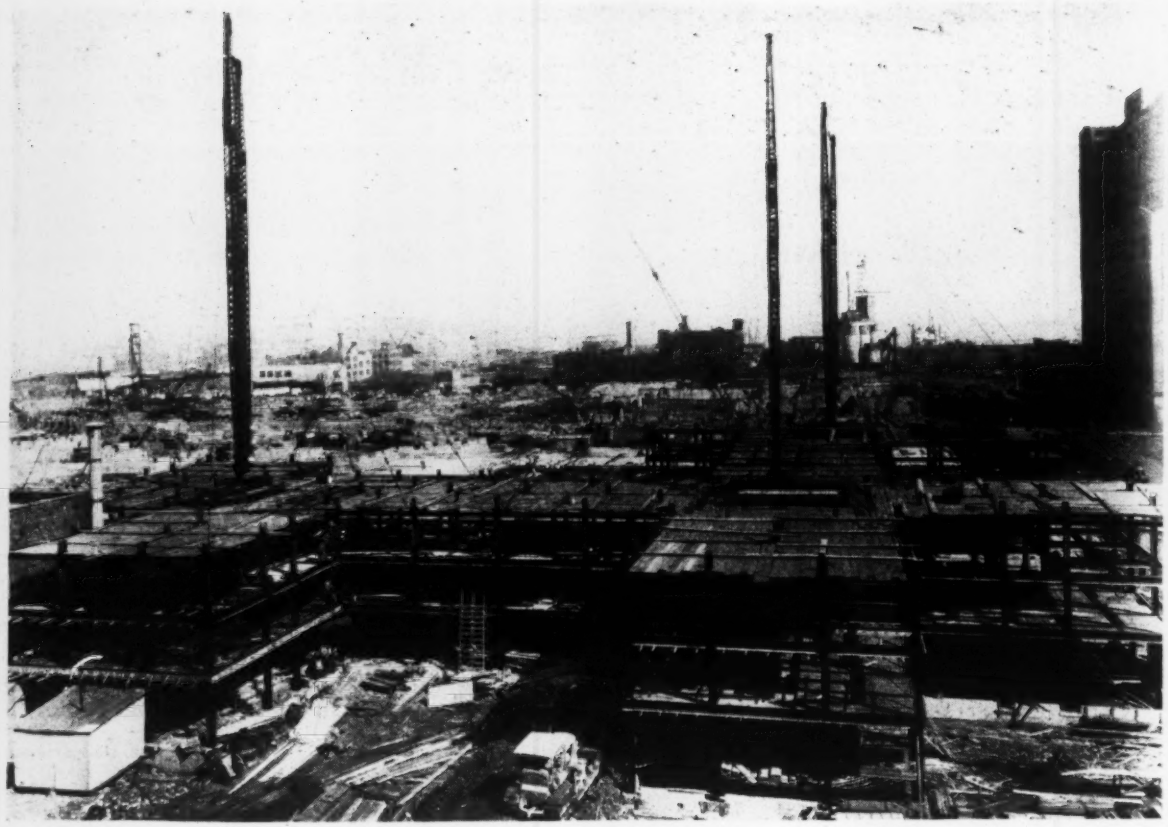


Fig. 1. Crawler cranes set the steel for the lower floors and then erected the derrick that placed the high steel.

Bolting 43,000 Tons of Building Steel

ERECTION of the steel frames for the 35 buildings at Stuyvesant Town was simplified and speeded by thoughtful design followed by accurate fabrication and well planned field procedures of the Bethlehem Steel Co. The large number of duplications justified almost any expense for original accuracy in fabrication to prevent difficulties in assembly.

Ease and speed of erection were designed into the structure. Bolting of field connections made unnecessary the usual riveting gangs with scaffolds, forges and compressors. A grid pattern with most of the interior beams on the column lines eliminated many small pieces of steel, reduced connections to be made in the field and made handling of pieces easier for the erectors. Total steel amounted to about 86,000,000 lb. and compares with the total of 83,300,000 cu.ft. of building space.

There are two fundamental designs for the steel frames of the 35 buildings, which consist of 75 cores labeled C and 14 cores labeled F see p. 76. Details for fabrication were made on single "Master Plan" and "Master Detail" sheets. Variations from these were noted for specific buildings. For example, special columns were required for the full height in the four cores that have water towers rising an additional 60 feet above the roof. Erection drawings were made the same way so that single sheets were adequate for field use.

With a large number of almost identical cores, it was mandatory that fabrication be accurately detailed to eliminate non-essential work in both shop and field and that no errors be permitted. Extra checking took care of almost everything. Special liaison with the field corrected minor deficiencies found on the first steel before additional members were fabricated.

Steel was fabricated at Bethlehem, Pa., and shipped by rail to ground storage on the New Jersey side of the Hudson River. Members were moved as needed by a lighter to a pier on the East River adjacent to Stuyvesant Town. From the wharf it was trucked to the building under erection and was hoisted directly to the planned position.

Cranes set low steel

Fabricated steel came to the job in "tier" lengths, the 17 ft. required for two-floor heights. The first two tiers above the foundation, to the fourth floor, were set by crawler cranes. These cranes then set up a light erection derrick at about the center of each core of the building.

Eight erection derricks were used —with 80-ft. mast and 72-ft. boom

Fig. 2. A total of eight derricks were used for erection of the 43,000 tons of steel. A derrick was set at the center of each of the 89 cores and raised in two-floor jumps to the top, then moved to another building.

for C cores and 90-ft. mast and 80-ft. boom for the larger F cores. Eight guys were used on each rig, attached to the steel frame by turnbuckles.

Five raising gangs set the steel, moving from one core to another as each tier was completed. The crew consisted of a foreman, hoisting engineer and six bridge men, a total of eight. The frame was plumbed as required by conventional cables and turnbuckles. When the top was reached, the derricks were taken down from the 118-ft. high structure by a crawler crane with a 130-ft. boom.

Work speeded by bolting

Bolting the frame greatly speeded completion of the steelwork. One or two permanent bolts were used for the erection as the steel was swung into place. Additional bolts to complete each point were placed by bolters-up working immediately behind the raising gang. Nuts could be run up most of the way by hand and required only a turn or two with a spud wrench to complete the joint. A toothed-washer under the head of the bolt kept it from turning while the nut was turned up. Scaffolds were not necessary as the raising gangs and bolters-up were accustomed to working from the steel.

In addition to the ease of erection with bolts, another time advantage was gained as riveters were not available anywhere in the East for this quantity of work.

Stairs for the buildings are of steel, bolted to the structural frame. They were set by a separate ornamental iron crew following behind the steel erection. For ease of access for all workers, stair erection was kept as close as practical to the steel level.

Fig. 3. Shop connections of steel were riveted but field connections were bolted for the 43,000 tons of steel used at Stuyvesant Town.

Materials hoists attached to steel

As rapidly as steel was erected material hoist towers were set up. A single-cage, 4,500-lb. capacity unit was provided at two or three points at each building, depending on the size. The hoist platforms were 6 ft. 6 in. square, large enough to accommodate two wheelbarrows.

The tower units were made of heavy interlocking pipe erected in sections. Around the hoist tower proper, 6-ft. wide work platforms were provided to facilitate moving wheelbarrows and materials on and off. The work platforms were supported on auxiliary pipe frames built into the hoisting towers.

As soon as the steel was topped out, the pipe scaffold frames were completed so that all the material needed for construction could be readily hoisted. Towers were generally about 150 ft. high, 33 ft. above the roof, but a few extended to 190 ft. where water towers were to be built above the structure.

Eight men could erect such a hoist tower in three days or take it down in two days. At Stuyvesant Town 47 towers units were in use, some of them being reused at three buildings.

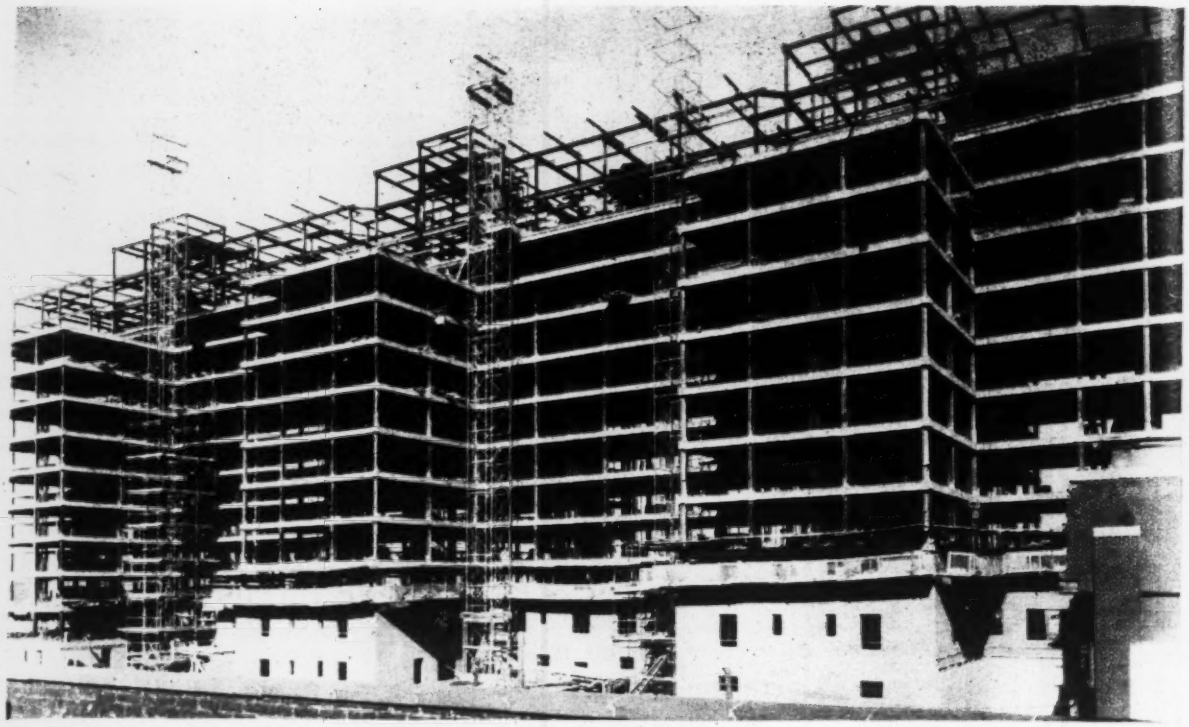


Fig. 1. Separate bucket hoists for concrete supplemented the platform hoists used for masonry and other materials at Stuyvesant Town. Bricklayer's scaffolds were hung from the top of the buildings and were served from the nearest floor.

Inclosing a Multiple-Story

Fig. 2. Forms were hung by heavy wires from the steel frame.

CINDER CONCRETE was used for floors and fireproofing of the 35 apartment buildings at Stuyvesant Town. For the walls, brick, backed with cinder-concrete block was laid from scaffolds swung from the top of the 12- and 13-story buildings. Plasterboard and gypsum block partitions finished with plaster complete the structural elements. Taken together they comprise economic building units and countribute to efficient construction.

Forming for 220 acres of floor

Cinder-concrete floors and beam encasements were constructed with wood forms hung from the steel frame for the 220 acres of floor required by the project. Ceilings were plastered, so that emphasis could be placed on economy of construction rather than finish of the concrete.

A beam bottom of 1-in. rough-sawed lumber was hung from the horizontal steel, using No. 8 wires at 3-ft. centers, crimped over the beam. Side forms for the beams had horizontal 2x4 runners that supported rough 2x4 joists at 14-in. centers, which in turn carried panels of 1x6 T&G lumber on which the concrete was placed.

Between the steel beams the 2x4's were supported on 4x8 timbers at 5 ft. centers. The 4x8's rest on rough 2x12's on edge, hung from the steel by two No. 4 wires, Fig. 2. Wire mesh was unrolled over the form to serve as the reinforcement.

Cinder concrete with a minimum 28-day strength of 800 psi. was delivered by transit-mix trucks to a tower elevator that raised it to any floor. One or two such towers were put up on each building and used while the floor concreting was in progress.

Ten concrete hoist towers proved adequate for the job of placing 300,000 cu. yd. of concrete for the floors. The hoist were moved from building to building, a crew of four erecting the 130-ft. high tower in 14 hr. or taking it down in 8 hr. A 14-ft. deep pit at the foot of the hopper permit-

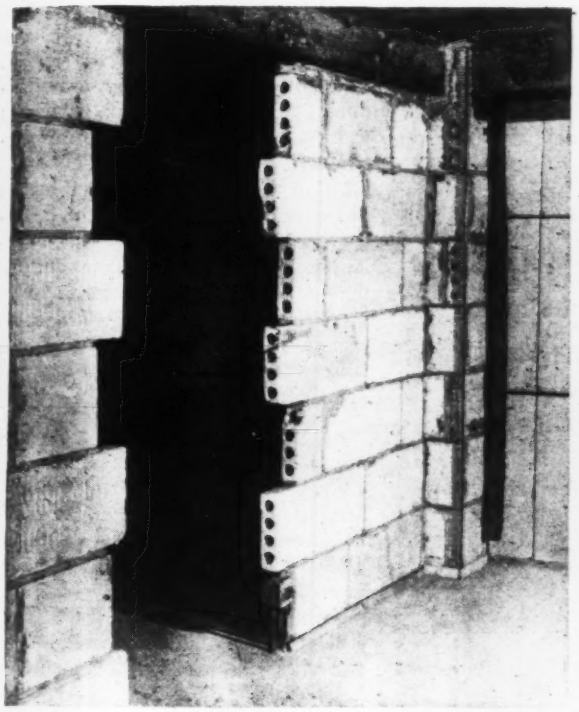


Fig. 4. Hollow gypsum block were used for partitions between apartments. The opening shown is a temporary one.

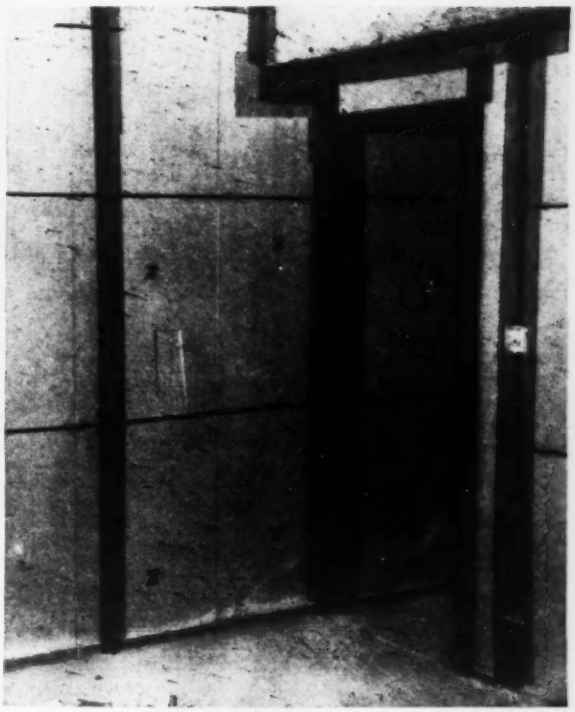


Fig. 5. Plasterboard ½ in. thick was held in alignment by small horizontal metal channels and vertical angles.

Skyscraper Housing Project

ted discharging a 9-cu. yd. truck immediately. From the pit a 1½-cu. yd. bucket was filled for hoisting to the desired floor, where it dumped into a hopper that could be moved along the tower face to the required elevation.

Two-wheel buggies were used for concrete distribution. Concrete was screeded and wood floated to give it a level but rough surface to hold a mastic on which wood or asphalt-tile flooring was laid.

Forms were provided for four floors of a building. They were handled manually, usually being moved up about three floors at a time.

Forming for the floors followed steel erection very closely, partly because of a New York City building code requirement that steel cannot be raised more than eight stories above a completed floor.

As fast as the floors were concreted, material for windows, doors, walls and partitions was carried up to the floors where needed and dis-

Fig. 3. Cinder concrete block was used to back up the exterior brick wall and for fireproofing of exterior columns of the thirty-five buildings.

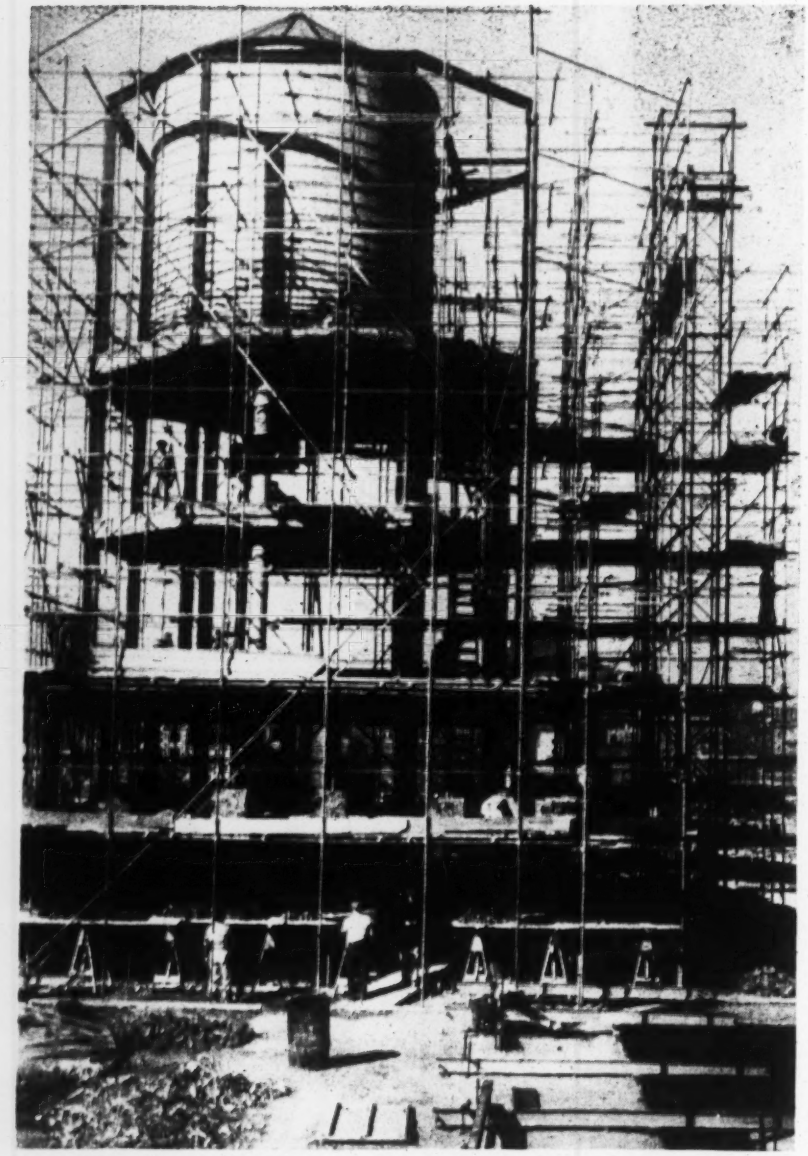


Fig. 6. One of four water tanks erected on top of the Stuyvesant Town Buildings. The wood-stave tanks are on a steel-frame tower and are inclosed with brick for appearance. Adustable pipe scaffold served the workmen.

tributed to point of use. Early distribution assured having the material when wanted, permitted utilization of the hoist at slack periods and solved the storage problem.

Mortar from central-mix plant

Exterior walls were built from the ground up, working from swinging scaffolds hung from the roof of the building. The wall was built up to the window-sill and left while the steel frame windows were set and plumbed. The wall then was completed to the bottom of the spandrel beam.

Brick and cinder-block back-up were laid in a 1:2 cement mortar purchased from a commercial central-mix plant that delivered it in agitator trucks. Deliveries at each building were only what could be used in two hours. Mortar was dumped in a large box and shoveled into wheelbarrows for delivery via the hoist to the bricklayers. The inside of the brick and cinder concrete block wall is permanently protected against wind-driven rain by a painted-on prime and troweled-on bituminous waterproofing.

Setting of metal frames for interior doors followed enclosure. Small channels were nailed to the cinder concrete to hold the top of the frame. The bottom was held by a nailed-down rummer of wood that was grooved to hold plasterboard for partitions.

All of the partitions and ceilings at Stuyvesant Town are plastered, including those of gypsum block, rock lath and the cinder concrete of the ceiling. Gypsum block was used for interior column fireproofing and around elevator shafts and stair wells and for partitions between apartments.

Partition construction

Partitions within apartments and furring of exterior walls are of rock-lath board and plaster construction. The partitions within apartments have a one-hour non-bearing fire-resistive rating and are of $\frac{1}{2}$″ thick rocklath boards with a scratch, brown and white coat of plaster on each face finished to a total thickness of 2″. The scratch coat is $\frac{1}{4}$″ to $\frac{3}{8}$″ thick; the brown coat is $\frac{3}{8}$″ to $\frac{1}{2}$″ thick; and the white coat is $\frac{1}{16}$″ thick.

During construction the rocklath board was held in alignment by small channels horizontally and angles vertically on one face of the rocklath. Tops of the vertical angles were held by a small channel nailed to the cinder concrete above while the lower end was fastened to the floor member.

Plaster was prepared in a mortar mixer at a central point on the ground adjacent to each of the buildings. It was raised to the required floor by a small tower hoist and distributed by hod. A mix of one part gypsum plaster to one part sand was used for the scratch coat; one part of gypsum plaster to two parts of sand was used for the brown coat. After the brown coat hardened the steel stiffeners, used to align the rocklath board, were removed and the openings filled.

Plastering on the furring of the exterior walls is similar, with aluminum foil insulation on the outside face of the rocklath board and about $2\frac{1}{2}$″ air space between the interior face of the exterior masonry wall and the outside face of the rocklath board.

Asphalt tile and squares of sanded oak flooring were laid in asphalt spread over the concrete floors.

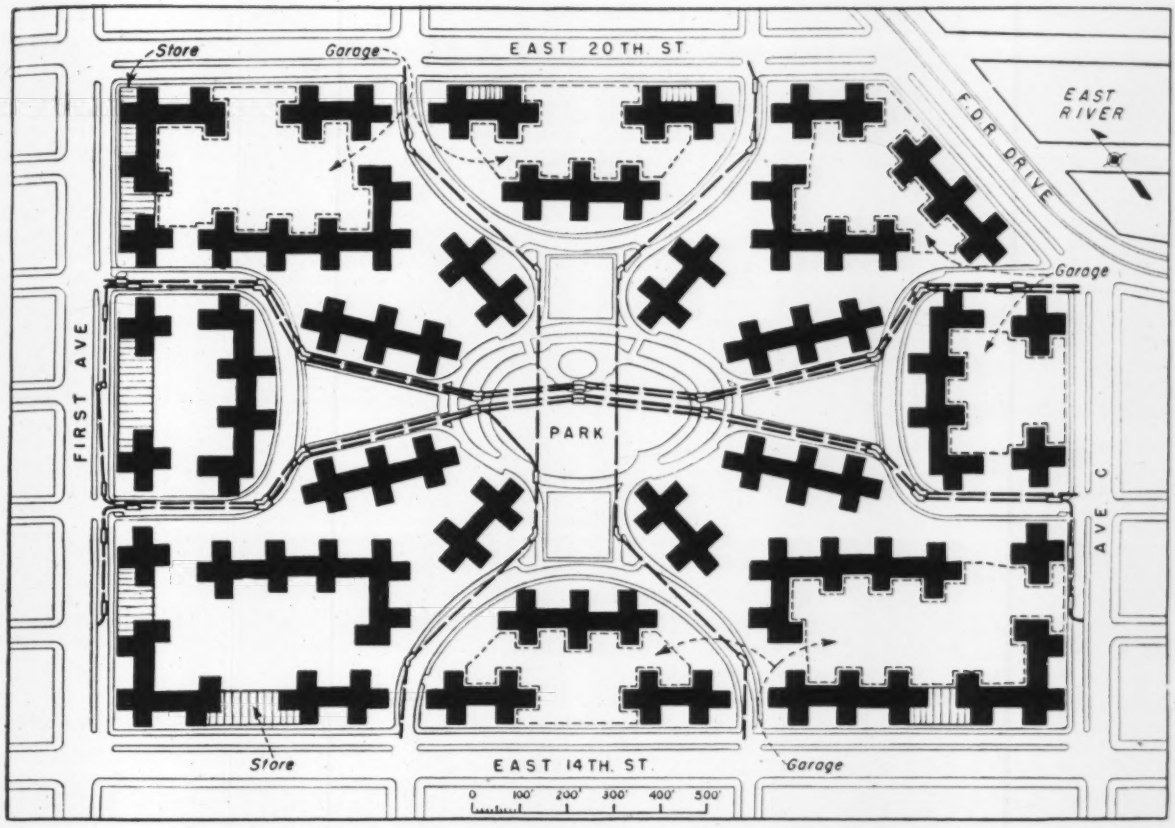


Fig. 1. New electrical facilities at Styuvesant Town were placed generally under paved areas.

Utilities for a City Within a City

***Contents in Brief**—Providing utilities for the 24,000 residents of Stuyvesant Town, which occupies a 75-acre site in the center of New York City, was a major project in itself. In addition to problems presented by new installations, others arose when abandonment of the grid street pattern necessitated relocation of most existing cables and mains, many of which were through-lines. The electric-power, heating and water-supply systems are of unusual interest.*

ALTHOUGH LOCATED in the heart of New York City, Stuyvesant Town could easily qualify by itself as a city. It has a population of 24,000, its own stores, streets, shops and playgrounds. Naturally, it is served by a complex network of utilities. And the planning of this installation was more complicated than usual because of the necessity of relocating existing facilities and of coordinating the new systems with those outside.

Stuyvesant Town is an 8,755-apartment rental project consisting of thirty-five 12 and 13-story buildings. It was built by the Metropolitan Life Insurance Co. to re-develop a run-down district bounded by East 14th and East 20th Streets, First Ave., Ave. C and Franklin D. Roosevelt (East River) Drive in midtown Manhattan (Fig 1). Apartment buildings occupy only about one-quarter of the 75-acre site. Between them are a 3-acre central park, 12 playgrounds, and six one-story garages for 1,700 passenger cars. The garages are located under the play areas.

In the redevelopment, the existing street grid was abandoned. Instead, paved local streets, separated from the main thoroughfares by a mall, now circumscribe the site. Heavy-duty paths and four roads, each of which forms a complete loop with the local streets, provide access to the interior for automobiles, and light-duty paths serve pedestrian traffic. Roads and paths throughout the project are paved.

Existing underground lines shifted

Formerly, the Stuyvesant Town site was a confluence of utilities that served not only the project area but surrounding neighborhoods as well. Placed under existing streets, the cables and mains were laid out in a grid pattern. Therefore, to accommodate the new layout of buildings, it was necessary to relocate gas,

Fig. 2. A mixture of asbestos and portland cement is applied over insulation on steam mains supplying Stuyvesant Town.

water and steam mains; city sewers; electric, fire-alarm and traffic-signal cables; and miscellaneous conduits.

Principal telephone lines were completely removed from the property. All but four city fire-alarm boxes were also shifted to points outside the site, those remaining being placed at convenient interior locations. The availability of alarm boxes to Stuyvesant Town residents is about the same now as it was with the old grid layout.

Fig. 3. Special single-lamp standards illuminate Stuyvesant Town paths

In addition to this relocation work, new service lines had to be installed. These included gas, steam, telephone, and fire-alarm systems; water service to storage tanks, buildings, fire lines, hydrants and interior irrigation systems; and an interior drainage system to supplement existing services in city streets that were closed. Also, with the abandonment of the old streets, light standards had to be shifted, and provision had to be made for illuminating the new private streets.

City lighting standards are located along the perimeter of the project. Most of these are of the single-lamp type, but at some places on the mall separating the city streets from the circumferential local streets, twin-lamp type standards are used. Operated by astronomical time switches, special single-lamp standards (Fig. 3) and lights attached to the buildings illuminate the interior of the site.

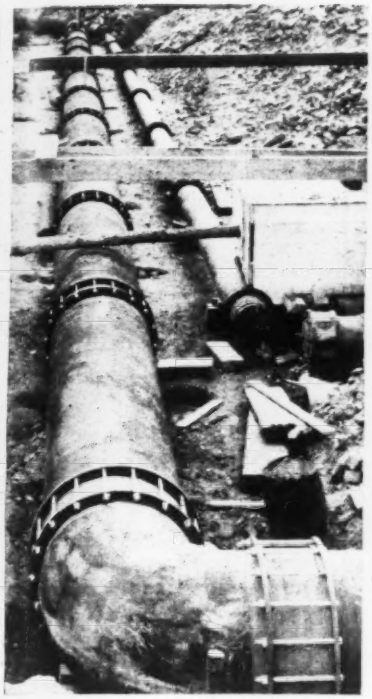
Power for the lighting is supplied through subsurface cables. In fact, all utility lines are installed underground, with depths below the surface varying from 3 to 10 ft. Wherever possible, main lines are located under paved areas to permit access by utility company repair trucks (Fig. 1).

The new main lines are also through-lines, their layout within the site conforming to the new building locations to shorten the required length of the distribution network and avoid subsurface obstructions.

Old cables hampered new work

Typical of the problems faced in installing the services for Stuyvesant Town are those encountered by the Consolidated Edison Company of New York, Inc., which provides utility services in all of Manhattan and most of Greater New York. For example, removal of the grid system through which electrical energy was formerly provided was complicated by high-voltage cables that passed under two streets in the development area without supplying buildings there. These cables, totaling some 250,000 ft., had to be taken out. In addition, about 93,000 ft. of cable that were used to provide electricity in the area and 38,000 ft. of gas mains were extracted.

To supply the electrical requirements of Stuyvesant Town and adjacent Peter Cooper Village, another Metropolitan Life Insurance Co.



Dresser Industries, Inc., photo

Fig. 4. These 12 and 30-in. cast-iron mains are part of the 13,000 ft. system.

Fig. 5. Welders join sections of the 24-in. insulated steam main after installation in a cast iron casing. A sleeve to close the gap between units is on the left.

housing project, which will shelter 3,495 families, Consolidated Edison installed 16 transformer vaults and 5 transformer manholes. These contain sufficient equipment to provide 12,500 kva. at present, and provide space for apparatus to supply an extra 6,000 kva. for load growth.

Nearly 350,000 ft. of cable were installed to distribute electricity to the two projects, and the through-cables were replaced with 147,000 ft. of new lines. Also, some 13,000 ft. of gas mains with special rubber-gasketed joints were installed to replace facilities that had been removed (Fig. 4).

Further complicating the utility installations, tidal conditions affect a portion of the subsurface of the Stuyvesant Town area. Since equipment in the transformer vaults is not submersible, the latter are constructed of 8-in. thick reinforced concrete and provided with drainage pumps. Where cable ducts enter vaults, a water-proof concrete seals the joints.

Cable ducts are formed of jointed sections of precast concrete. After placement, the duct bank that was exposed to tide water was covered with a cast-in-place concrete envelope.

To reduce electrolytic corrosion of the lead-covered cables, a protective hose jacket was applied to lines installed in the tide-water areas. In regions where corrosive conditions are less severe, a corrosion-inhibitive grease was applied to the cables as they were pulled into the ducts.

Steam purchased for heating

Subsurface water also created problems affecting the steam supply. These problems arose mainly as a consequence of a decision to use central-station steam service for space and water heating at Stuyvesant Town.

About a half billion pounds of steam will be supplied annually by the New York Steam Corp. from an existing major plant located about one block from the project. The proximity of this station made it economical to return the condensate to the steam company, and for this purpose, brass pipe is used.

Steam is brought to the development at a pressure of 150 to 175 psi. in a welded steel main, 24 in. in diameter. This line connects to an existing main, which runs under 14th St. and supplies the southerly portion of the project. The remainder of the development is served by an extension of the new main along Ave. C and 20th St. These mains are tapped at fourteen points by 6-in. dia. service lines, each of which leads to a control room in an apartment house on the periphery of the project.

The new steam lines are insulated with a material consisting of 85 percent magnesium carbonate combined with asbestos fiber. It is molded into blocks and semi-cylindrical pipe sections, and was chosen because of its low thermal conductivity and to minimize maintenance, since it is moisture-resistant and does not corrode the piping.

The 24-in. main was laid in 40-ft. sections, which were later welded together to form a continuous pipe. Before being placed, each section was insulated with a double layer of 2-in. thick magnesia block, held in place by copper wire. Joints of the outer layer were staggered with respect to those of the inner. Over the outer layer, to protect the insulation during installation of the pipe section in the 5½-ft. deep trench, a hard finish consisting of a mixture of asbestos and portland cement was applied (Fig. 2). A short length of

pipe was left uninsulated temporarily to permit welding the sections.

The problem posed by tidal conditions was solved by placing the main in a water-tight jacket. This protection is provided by a 42-in. dia. cast iron casing with lead-calked bell and spigot joints, which come in sections about 13 ft. long. Since three lengths of casing total less than 40 ft.—the length of a section of steam pipe—an opening is left that is utilized in installing the steam pipe and welding the joints (Fig. 5). The pipe sections were inserted in the casing with one end resting on a dolly, which later was removed through the opening. After the welds were pressure-tested and insulation applied to the bare ends of each pipe, a sleeve was used to close the gap, and all joints were calked with lead.

To prevent chafing of the insulation as the pipe expands and contracts with temperature change, roller and saddle units are installed on either side of the welded joints. The saddles, designed with surfaces extending beyond the insulation, are welded to the pipe, and the rollers are placed in guide frames braced against the bottom of the casing.

To provide further for the movement of pipe with temperature change, bellows-like expansion joints are located in pairs in manholes about 320 ft. apart, with anchors midway between, thus providing an expansion joint for every 160 ft. of main. Anchor points are also placed in each manhole between the joints.

Because of the expansion and contraction, service pipes may be connected to the main only at anchor points. These lines are insulated with 3 in. of 85 percent magnesia.

Steam distribution in the site

In the fourteen control rooms to which the steam pipes lead, the pressure is lowered to 10 psi. for space heating and 5 psi. for water heating. Distribution mains carry the steam at the reduced pressure to buildings having no control rooms.

These lines are insulated and then finished with a 55-lb. roofing felt bound with copper wire. Insulation for 6-in. pipe is 1½ in. thick and for 8-in. pipe 1¾ in. thick. For protection, the pipes are laid generally in special, vitrified half-tile conduits on concrete bases. Under roads, cast iron conduit is used.

Conduits similar to those used for the steam lines also protect underground hot-water pipes. Heaters are located in the fourteen control rooms, and the domestic hot water is distributed to adjacent buildings by lines run through the garages or underground in tile conduits.

Single-pipe system heats project

The space heating system used at Stuyvesant Town is unique. It is known as the Metro system and was developed for Parkchester, a Metropolitan Life Insurance Co. housing project built in the Bronx, N. Y., in 1938. The installation was chosen for low initial and operating costs and for its satisfactory performance at Parkchester. However, some improvements were made over the original design.

At Stuyvesant Town, steam is supplied to the top of the building through 2 or 2½-in. dia. risers located in the bathrooms or kitchens and is distributed to single-pipe down-feed units. In each unit, a 1½-in. riser runs from the roof down through living rooms or bedrooms at successive levels to the steam return main. In each room through which it passes, this pipe is placed alongside a window. Below the stool, it is connected to a convector consisting of a single, finned steel pipe. The heating element runs under the window and in turn feeds the steam to a riser that passes alongside the window of the floor below.

Since the convectors are in series, no one heating unit can be shut off, nor can orifice plates be used. No traps or valves are provided in the apartments. Therefore, to regulate the heating of the rooms it is necessary to keep the convectors continuously full of steam at a controlled temperature. This is achieved by varying the steam pressure from about 2 psi. absolute to 17 psi. absolute, depending on outside temperatures. An average value of the vacuum is expected to be around 10 psi., which corresponds to a steam temperature of 160 deg.

Each building has its own control valves and vacuum pumps, but heating controls are centralized in the fourteen control rooms previously mentioned. Further adjustment of room temperature can be exercised by the tenants by means of dampers on the convectors.

Another installation of interest is the water-supply system. Stuyvesant Town is furnished with water by the City of New York. The supply was obtained by tapping existing 36 and 48-in. mains in border streets and through a new 20-in. cast-iron pipe, which encircles two-thirds of the site. Little of the existing city grid system in the area could be used for distributing the water because of its age and condition and because of the entirely changed layout of buildings. It was replaced by four 12-in. cast-iron supply lines carried into the interior of the development.

Incoming water is pumped to wood tanks located above the roofs of four central buildings, in each of which an interconnected pair of 500-gpm. centrifugal pumps is provided for pumping. For appearance, the sides of the tanks are inclosed in brick. Having a capacity of 33,000 gal. each, with the lower 5,000 gal. reserved for fire purposes, the tanks feed underground fire and domestic mains from which water is supplied to all buildings.

Each main forms a loop, with sectionalizing valves inserted between the house connections, so that water will be available even with three tanks out of service. Water pipe below ground is cement-lined cast-iron and in the buildings red brass.

Because the New York City code requires separate water risers when flush valves are used in water closets, Stuyvesant Town toilets utilize low-down tanks. To dispose of the domestic sewage, use is made of the original sewers, which with some repairs were found suitable. In a few places, some of the older sewers had to be detoured and also supplementary piping installed.

The satisfactory solutions of the complicated problems encountered in these utility installations resulted from the close cooperation throughout all stages of the work of the city departments, the utility companies and the consultants employed by the Metropolitan Life Insurance Co. The same degree of cooperation existed in all phases of the Stuyvesant Town project, and for this credit is due the Board of Design and the builders.

MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

March Materials and Labor Prices will appear in the March 18, 1948 issue

Mexico City, Mexico prices are published in this section of Engineering News-Record each month.

CEMENT, AGGREGATE, READY-MIXED CONCRETE — F. O. B. CITY

	PORTLAND CEMENT* Per bbl. C/L lots incl. $1.00 per bbl. for bags, cash, dis. not deducted			SAND AND GRAVEL Per ton, carload lots			CRUSHED STONE Per ton, carload lots		CRUSHED SLAG Per ton, carload lots, f.o.b. plant		CONCRETE BLOCK 8x8x16-in.; truckload del.; per block	CONCRETE Ready Mixed 1:2:4, over 50 c.y. del.
	Cloth	Paper	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand grav.	Lt.wgt. Agg.	per cu. yd.
Atlanta	$4.03	$3.26	$2.98	$2.00	$2.00	$1.75	$2.10	$2.10	$1.65	$1.85	$0.1725	$0.1725	$11.00
Baltimore	3.91	3.14	2.86	2.20*ff*	2.20*ff*	1.80*ff*	2.40*ff*	2.50*ff*	2.35*ff*	2.25*ff*	.145	.145*ee*	9.20
Birmingham	3.65	2.88	2.55	2.06	2.06	1.66	2.50	2.50	1.00	1.20	.15	.15	7.45
Boston	4.39	3.62	3.34	1.50‡*t*	1.50‡*t*	1.40‡*t*	1.25‡*t*	1.35‡*t*	....	....	.186	.195*ee*	10.50*ss*
Chicago	3.65	2.85	2.60	2.70‡*d*	2.70‡*d*	2.95‡*d*	2.60‡*d*	2.60‡*d*	2.00‡	2.00‡	.20	.20*x*	....
Cincinnati	3.69	2.89	2.64	1.70‡*bb*	1.70‡*bb*	1.60‡*bb*	2.75‡*bb*	2.75‡*bb*	....	....	.17	.195	9.00*hh*
Cleveland	3.82	3.05	2.72	1.90*lliq*	1.65*llq*	1.25*ll*	3.20‡*h*	3.20‡*h*	2.45	2.45	....	.20	11.20*kk*
Dallas	3.57	2.80	2.52	2.00	2.15	1.75	2.00	2.10	....	....	.0775*p*	....	8.85
Denver	4.03	3.23	2.98	1.85	2.00	1.15	....	....	....	....	.20	.2175*ee*	9.65*ll*
Detroit	3.54	2.74	2.49	3.00‡	3.00‡	2.75‡	2.75‡	2.75‡	2.75‡	2.75‡	.17*ee*	.18*ee*	9.15*kk*
Kansas City	3.68	2.88	2.63	1.90	1.90	1.40*t*	1.45*q*	1.45*q*	....	....	16*aef*	.175*aq*	9.60*n*
Los Angeles	....	3.60*h*	3.20*h*	1.92*t*	2.02*t*	1.72*nn*	1.92*t*	1.92*t*	....	....	.08*aa*	....	9.90*nn*
Minneapolis	3.91*dd*	3.14*dd*	2.86*dd*	2.10*h*‡*j*	2.10*h*‡*j*	1.20*h*‡*j*	2.20*h*‡*j*	2.20*h*‡*j*	....	....	19*eea*	....	10.65*jkk*
Montreal	....	2.29*e*	2.14*r*	1.78*bbs*	1.78*bbs*	1.10*s*	1.55*cs*	1.80*cs*	....	....	.1936	.21*ee*	7.75*ls*
New Orleans	3.63	2.86	2.58	2.13	2.13	1.67	....	....	.90	1.15	23	....	16.65
New York	5.00‡	4.00‡	....	1.85*de*	1.85*de*	1.30*de*	2.00*de*	2.00*de*	....	....	.16‡.18*ii*	.16‡.18*eeii*	10.50*ii*
Philadelphia	3.62‡	2.85‡	2.57‡	2.20‡	2.30‡	2.05‡	1.90‡	1.95‡	1.50	1.50	.20‡.22	.20‡.22*x*	9.25
Pittsburgh	3.78	3.01	2.73	2.05‡	2.05‡	2.35‡	2.50‡	2.50‡	2.05	2.05	.22*z*	.22*z*	10.85
St. Louis	3.76*o*	2.99*o*	2.71*o*	2.35‡*oh*	2.35‡*oh*	2.00‡2.35‡*oh*	1.50*e*	1.50*e*	1.15	1.15	.195	.22*go*	10.40
San Francisco	....	3.36	2.96	1.77	1.77	1.87	1.87	....	....	....	....	.25*g*	10.75*ss*
Seattle	....	3.20*mm*	2.80*mm*	2.50‡*od*	2.50‡*od*	2.50‡*od*	3.00‡*od*	3.00‡*od*	....	....	.18*e*	....	9.00*e*

‡ Delivered. *a* F.o.b. truck at plant. *b* 10c. per bbl. off for payment by 10th of following month. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks. *f* F.o.b. truck on job. *g* Pea gravel. *h* Truck Lots. *i* 1½ in. *j* 5% discount for cash. *k* Discount of 2 percent for cash in 10 days. *l* 2000 lb. concrete. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 5½ x 8 x 12 in. *q* F.o.b. car or truck at plant. *r* 10¢ per bbl. off cash 20 days. *s* 8% sales tax included. *t* Truck delivery. *u* 10 to 100 c.y. brackets. *v* Cinder. *x* Waylite. *y* Haydite. *z* Celocrete. *aa* Aver. haul, 7–9 mi. zone. *bb* under 5 tons. *cc* Also 8 x 8 x 18 in. *dd* Dealers sell only in LCL. This is price for CL and does not include dealer's commission. *ee* 20c refund for each returnable bag. *ff* LCL. *gg* 10c refund for each returnable bag. *hh* Truck loads up to 500 c.y. Over 500 c.y lots, 50¢ less per yd. *ii* Yard price. *kk* 2500 lb. compression strength. *ll* 30¢ refund for each returnable bag. *mm* Price at plant, called for. *nn* 10¢ per bbl. off cash 10 days. *oo* Concrete sand. *aa* 4x8x12 std. wgt. * Prices include dealer's commission except where indicated to the contrary. † Correction: Jan. price was $8.65.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal

CURRENT MAXIMUM PRICE BASES AT CEMENT MILL

Charge for bags not included. For cloth bags, add $1.05 per bbl.; 25c. refund allowed for each returnable bag; for paper bags add 28c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$2.10	$2.10	Ironton, Ohio	$2.15*	$2.15*	Universal, Pa.	$2.20	$2.20
Hannibal, Mo.	2.20	2.20	Northampton, Pa.	2.15	2.15	Waco, Tex. (Plus 9c. tax in Tex.)	1.95	1.95
Independence, Kans.	2.20	2.20	Richard City, Tenn.	2.20	2.20	Montreal City (Discount 10c. per bbl. 20 days)	1.98	1.98
			Steelton, Minn.	2.30	2.30			

* Destination price base effective Dec. 22, 1947

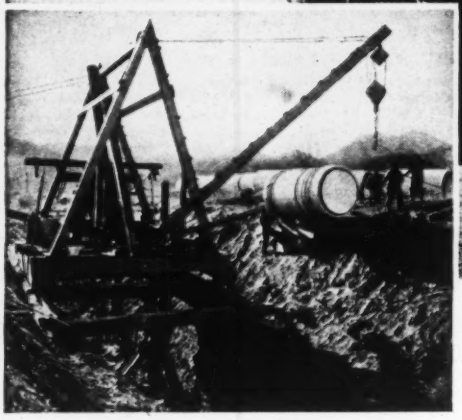
PAVING BRICK, BLOCK, ASPHALT, ROAD OILS — F. O. B. CITY

	PAVING BRICK AND BLOCK			PAVING ASPHALT Per ton, less than 80 penetration		ASPHALT BINDERS—FLUXES Per gal., 80–300 penetration		CUTBACK ASPHALT Per ton		ROAD OIL Per gal.	ASPHALT EMULSION (Quick-breaking) Per gal.	
	Granite per M lots of 50,000 4x4x8 in.	Brick per M 3¼x4x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	$35.00	$2.25	$14.00	....	$0.074	....	$0.0806*h*	....	$0.0781	$0.0806	....
Baltimore	150.00‡	52.70‡	....	15.00	$21.00	.0925	$0.1225	15.00	$25.00	10	.095	$0.115
Birmingham	....	32.00	....	....	....	....	....	....	....	....	....	....
Boston	85.00	59.00	3.75	17.00*a*	29.50*a*	.0723*a*	.1447*a*	.075*ha*	.15*ha*	.07*a*	.0907*a*	.18*a*
Chicago	150.00‡*y*	75.00/80.00*e*‡	2.97/4.10*d*‡	22.50*b*	32.00*b*	21.50*bg*	31.00*bg*	.097/.106*h*	....	.082/.0845*b*	.0925/.1025*b*	.14/.165*b*
Cincinnati	....	....	....	19.40*z*	....	....	....	....	....	....	....	....
Cleveland	186.52	47.00*t*	3.84	....	....	....	....	....	....	....	....	....
Dallas	*l*	40.00	*l*	23.38	42.17	.0987	.1837	26.15	46.65	.0862	.1037	....
Denver	....	40.00	....	....	....	....	....	....	....	....	....	....
Detroit	....	63.00*x*	....	20.00	26.00	18.40*g*	24.40*g*	.0811*h*	.128*h*	.075	.1085	.1522
Kansas City	....	40.00	....	17.60	....	16.00*g*	....	.075*h*	....	.0675	.09	....
Los Angeles	*l*	....	*l*	14.00*hf*	30.75	14.00*g*	30.75	14.50*h*	31.25	....	....	....
Minneapolis	....	....	2.74*d*	26.00	35.00	22.00*g*	33.00*g*	26.00	37.00	.10	.12	.22
Montreal	125.00	....	....	21.60*k*	31.25*k*	14.10*kp*	18.35*kp*	14.00*kp*	16.00*kp*	12.58*kj*	.153*k*	.194*k*
New Orleans	....	....	....	20.00*a*	....*s*	20.00*ga*	....*s*	9.50*a*	....*s*	.095	.0975	.16*a*
New York	....	....	2.50*d*	25.95	36.35	24.95*g*	42.79*g*	.1068*h*	.1832*h*	.1018	.1066	.1808
Philadelphia	150.00	62.00	4.06	19.00	....	17.00*g*	....	.08*h*	....	....	....	....
Pittsburgh	165.00	42.00	4.10	22.00	34.00	.11	.20	23.00	36.00	.09	.10	.20
St. Louis	....	48.50	....	16.50/17.50	22.50/23.00	15.50/16.00*g*	21.50/22.00*g*	.075/.08*h*	.165/.17*h*	.065/.07	.075/.095	.125/.155
San Francisco	....	57.75*e*	....	16.50	33.75*e*	16.50*g*	....	17.50	....	....	.0625	.1325
Seattle	....	....	....	14.50*k*	31.00*k*	13.00*eq*	....	15.00*k*	19.00*wk*	14.00*q*	.0625*k*	.0725*k*

‡ Delivered. *a* F.o.b. Baton Rouge. *b* F.o.b. Refinery. *c* 2½ x 8½ x 4 in. *d* 2-in. interior block, 6-lb. treatment. *e* 3½ x 4 x 8. *f* 40–300 penetration. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* Shipped in drums, per drum. *k* Tax included. *l* Not used. *n* 55 gal. drums. *q* Price at plant. *p* Per 100 gal. *s* Drums not available. *t* Truck deliveries in Greater Cleveland. *w* Shipped in double head wood barrels. *x* Truck deliveries in Detroit $75.00. *y* Carload lots. *z* 50–300 penetration. *aa* In customer's drums.

LOCK JOINT REPEAT PERFORMANCES

DENVER



13 JOBS SINCE 1920

1940 – Above: Installing 48" pipe through center of street in residential area.

1921 – Left: Installing pipe with old type wooden derrick astride ditch.

To meet the enormous demands of increasing population and expanding industry, Denver has steadily extended its water supply system. Since 1920 Lock Joint Pipe Company has been awarded 13 major water works contracts totalling approximately 90 miles of Reinforced Concrete Pressure Pipe. Such repeat orders, not only for Denver but for many other key cities, are convincing evidence of the incomparable quality of Lock Joint Reinforced Concrete Pressure Pipe.

The life expectancy of Lock Joint Reinforced Concrete Pressure Pipe has been rated at better than 100 years. During this life span Lock Joint Pipe will retain its characteristic high qualities: immense structural strength, permanent high carrying capacity, low maintenance cost and unfailing service.

SCOPE OF SERVICES—*Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.*

For future projects, large or small, specify Lock Joint Pipe.

A Hazen-Williams Hydraulic Slide Rule will gladly be sent upon request with our compliments.

LOCK JOINT PIPE COMPANY

Established 1905

P. O. Box 269, East Orange, N. J.

Pressure Pipe Plant: Wharton, N. J. • Sewer Plant: Kenilworth, N. J.

BRANCH OFFICES: Denver, Colo. • Chicago, Ill. Kansas City, Mo. • Rock Island, Ill. • Joplin, Mo. Valley Park, Mo. • Cleveland, Ohio • Hartford, Conn. Navarre, Ohio

LOCK JOINT *Reinforced Concrete* PRESSURE PIPE

IRON AND STEEL PRODUCTS — BASE MILL PRICES

	STRUCT. SHAPES— PLATE[e]	REINF. BARS billet[be]	RIVETS ½-in. structural[f]	WIRE NAILS Base[df]	SHEET PILING Base[f]	STEEL RAILS Per Net Ton: Standard	Light	Re-rolled	TRACK SUPPLIES[c]: Angle Bars	Std. Spikes[c]	Tie Plates[c]	Track Bolts
Birmingham	$2.80	$2.75	$5.65	$4.25-5.00	....	$55.00	$62.00	Not	$3.85	$4.85	$3.65	$7.00
Chicago	2.80	2.75	5.65	4.25-5.00	$3.30	.....	.....	avail-	3.85	4.85	3.65	7.00
Pittsburgh	2.80	2.75	5.65	4.25-5.00	3.30	55.00	62.00	able	3.85	4.85	3.65	7.00
Buffalo	2.80	2.75	....	....	3.30	.....	.....	....	....	....	3.65	....
Cleveland	....	2.75	5.65	.. 4.35	....	.....	.....	....	....	....	....	....
Youngstown	....	2.75	....	....	....	.....	.....	....	....	4.85	....	....
Detroit	....	....	....	....	....	.....	.....	....	....	....	....	....
Gulf ports	....	....	....	....	....	.....	.....	....	....	....	....	....
Geneva	2.975‡	....	....	....	....	.....	.....	....	....	....	....	....
Los Angeles	3.41/3.47‡	3.325‡	....	....	....	.....	.....	....	....	....	....	....

‡ Delivered. *b* Rail steel price upon application. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports. On tie plates alone, Steelton, Pa.; on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per CL. *e* Mill lengths. Add 50¢ for cut lengths. *f* Per 100 lbs.

IRON AND STEEL PRODUCTS — F. O. B. WAREHOUSE, PER 100 LBS., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS[g] Per 100 lb., base price[u]: 5 tons to carload lot[b] New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH[k] Per 100 sq. yd., carload lots: Std. diamond mesh, 3.4 lb.	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq. ft., carload lots: 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in., No. 6 & 6 wires	SHEET PILING Per 100 lb. base price.
Atlanta	$5.12‡	$5.12‡	$5.12‡	$.025	$.10	$31.00	$33.00	....	....	....	....
Baltimore	4.68	3.96*l*	....	....	.10	33.50	35.50	$2.40	$1.66	$2.52	$4.25
Birmingham	4.25	4.40	4.40	.05	.15	40.00*p*	43.00*p*	....	....	....	....
Boston	4.97‡	4.72‡	4.19*a*	....	.10/.15	29.00	31.00	2.48	1.71	2.60	3.80‡*g*
Chicago	4.40	3.50*ff*	3.50*ff*	.05	.05	27.00‡	29.00‡	....	....	....	3.30*i*
Cincinnati	4.79‡	3.819*c*	3.819*c*	....	....	29.00*zeeii*	31.00*zeeii*	....	....	....	3.64*d*
Cleveland	4.68	3.39*c*	....	....	.10	29.00	31.00	....	....	..*t*..	....
Dallas	6.72	5.00	5.00	....	....	32.50	35.00	....	....	....	....
Denver	5.28	5.80*c*	....	....	....	40.00*s*	45.50*qs*	....	....	....	5.70
Detroit	4.77‡	4.58	4.58	....	.10	33.00*x*	35.00*q*	....	....	....	3.6512*g-l**
Kansas City	5.15*ee*	4.23*aak*	4.23*aak*	....	.10	34.00	36.00	....	....	....	3.8288
Los Angeles	5.15*f*	5.10	....	....	....	39.00	45.00	....	....	....	4.78*d*
Minneapolis	4.83‡	5.139*ccn*	5.139*ccn*	...	.15	29.50*k*	31.50*k*	....	....	....	3.8614
Montreal	4.90*i*	4.25*i*	4.25*i*	....	....	40.28*h*	42.98*h*	....	....	....	78.70*yd*
New Orleans	..	4.64*ok*	....	.05	.10	27.50	29.50	....	....	....	.....
New York	4.78*r*	4.55	....	....	.15/.20	30.00*st*	32.00*st*	2.46	1.69	2.58	3.35*s*
Philadelphia	4.52	4.59	....	....	....	30.00‡	32.00‡	2.41	1.67	2.53	3.41
Pittsburgh	4.40	4.40	4.40	.05	.10	32.50	34.50	2.24	1.56	2.35	5.05
St. Louis	4.73‡	4.45*bc*	4.45*bc*	....	.05	38.00‡	40.00‡	....	....	....	....
San Francisco	5.10	4.53†	....	....	....	32.50	34.50	....	....	....	4.85
Seattle	3.628*e*	4.43*el*	....	....	....	35.00*w*	38.50*w*	....	....	....	4.35*eld*

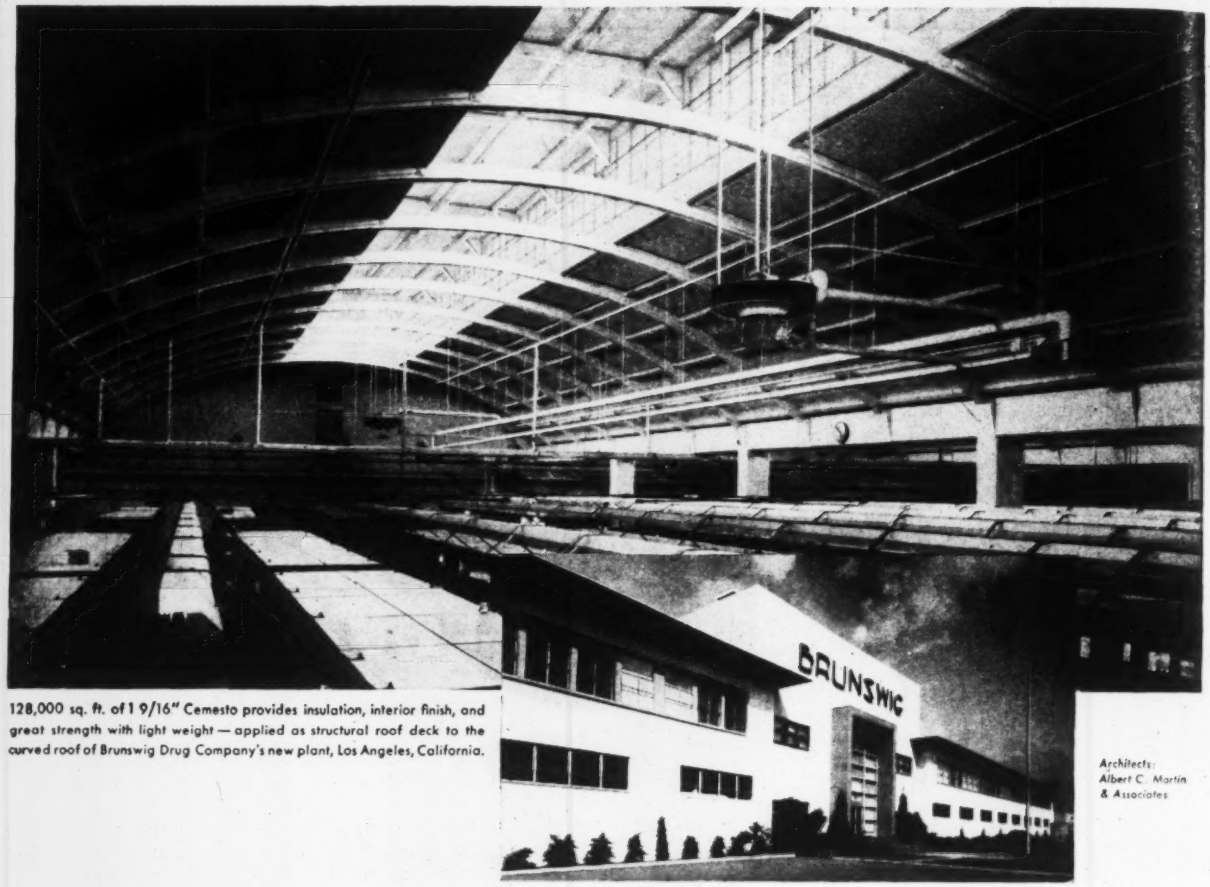
‡ Delivered. *a* Mill prices. *b* 1–5 tons, add 35c. Less than 1 ton, add 50c. *c* 20 tons or over base. *d* Mill price plus freight. *e* F.o.b. plant *f* Includes delivery in free delivery zone. *g* High scrap steel prices cut former 15c. differences between new billet and rail steel. *h* List price. Dominion tax exempt. Provincial and Municipal tax extra. *i* Plus Dominion, Provincial and Municipal sales tax. *j* Price per ton. *k* F.o.b. city. *l* Intermediate. *m* Per sq. yd. *n* 5 to 8 tons base. *o* 5 to 15 tons base. *p* Del. of 5000 sq. yd. or less. *q* Std. ribbed, 4 lb. per sq. yd. *r* 5 tons or over. *s* LCL. *t* Asphalt coated. *u* Note: Revised size extra—1 in., 1¼ in., 1½ in. 10c, ¾ in., ⅞ in. 15c, ⅝ in. 20c, ½ in. 35c, ⅜ in. 55c, ¼ in. $1.30. *v* Under 20 tons. Straight. *w* Copper bearing. *x* 2.5 lb. per sq. yd. *y* $.0093 transportation tax included. *z* Copper alloy. *aa* 20 tons base. *cc* F.o.b. cars Chic. plus freight. *dd* F.o.b. dock. *ee*F.o.b. cars. *ff* Carload lots. *gg* Unchanged since Sept. comparable Aug. std. diamond mesh price was $26; std. ribbed, $28. † Price includes quantity charge and size charge of 15¢ per cwt. for ¾".

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in.[a]	VITRIFIED SEWER PIPE Per foot, Delivered ASTM C13-44T: std. 8 in. s.s.	std. 12 in. s.s.	24 in.	36 in.	CLAY DRAIN TILE ASTM C4-24 Per 1,000 ft., carload lots, f.o.b.: 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered: ASTM C 14-41 12 in.	24 in.	WROUGHT STEEL PIPE** (Full standard weight, f.o.b. destination[s]) 2½ & 3 in., Butt Weld: Black %	Galv. %	3½ to 6 in., Lap Weld: Black %	Galv. %
Atlanta	$85.84	$0.43	$0.67	$3.39	$7.00	$114.00	$140.00	$0.45	$2.00	50.7	36.2	46.7	31.7
Baltimore	90.02	.378	.729	3.105	8.098	147.00	228.00	.80	2.20	54.4	39.9	50.4	35.4
Birmingham	79.50	.375	.675	3.06	....	210.00‡	375.00‡	.75	2.00	50.7	36.2	46.7	31.7
Boston	93.14	392*uux*	.756*uux*	3.465*uuy*	8.7125*uuy*	150.60	233.40	1.03*jcc*	2.75*jcc*	52.7	38.2	48.7	33.7
Chicago	92.17	54	1.04	4.12	12.80	150.00‡	270.00‡	.65	2.25	56.5*t*	42.0*t*	51.5*t*	36.5
Cincinnati	90.73	406	.783	4.00	12.00	155.00‡	240.00‡	.60	2.25	54.9	40.4	50.9	35.9*t*
Cleveland	92.74	.329*x*	.6345*x*	2.79*x*	7.893*x*	135.50	212.00	.58	2.25	57.15	42.65	53.15	38.15
Dallas	94.48	375	.675	2.70	6.20	109.00	131.00	.45	1.45	48.8	34.3	44.8	29.8
Denver	99.32	40*dd*	.71*dd*	2.98*dd*	....	.....	.....	.74*dd*	2.50*dd*	46.9	32.4	42.7	27.7
Detroit	92.74	.51	.98	4.31	10.79	170.00‡*m*	260.00‡*m*	.50	1.90	55.4	40.9	51.4	36.4
Kansas City	93.82	.39*m*	.705*m*	2.78*m*	7.15*m*	180.00*m*	310.00*m*	.50*t*	1.70*t*	52.2	37.7	47.8	32.8
Los Angeles	105.70	.414‡	.894‡	4.347	10.868	220.00	360.00	.65	....	....	....	....	....
Minneapolis	95.80	.55*mo*	1.05*mo*	4.10*mo*	....	.....	.....	1.19*h*	3.18*h*	52.3	37.8	47.9	32.9
Montreal	78.20	.73*z*	1.28*z*	4.20*z*	6.80*ez*	.60*paa*	.68*paa*	72.00*jkaa*	218.00*jkhaa*	....	....	....	....
New Orleans	88.72	.412	.762	3.955	9.15	231.00*bb*	.....	.55	1.95	50.3	35.8	46.3	31.3
New York	89.06	.62	1.14	4.39	11.20	.....	.....	1.00	2.25	53.7	39.2	49.7	34.7
Philadelphia	87.14	.50	.95	3.95	9.75	220.00‡	275.00‡	1.05*h*	2.75*h*	54.2	39.7	50.2	35.2
Pittsburgh	93.22	.364*m*	.702*m*	2.70*m*	6.625*m*	130.20	197.40	1.05*h*	2.50*g*	57.5*t*	42.0*t*	53.5*t*	38.5*t*
St. Louis	90.16	.40	.72	2.88	6.53	.....	.....	1.10*hl*	2.25*hl*	54.1	39.6	49.2	34.2
San Francisco	105.70	.438*d*	.878*d*	3.69*d*	9.23*d*	169.00*dl*	282.00*dl*	.69	2.85	....	....	....	....
Seattle	107.50	.45*b*	.81*b*	....	....	72.50*c*	.....	.595	1.80	....	....	....	....

‡ Delivered. † F.o.b. *a* B. & S. class B and heavier, CL, Burlington, N. J. (base) $84.50. Based on existing freight rates; subject to rate change. Gas pipe and class A, $5 per ton additional. 4 in., $5 per ton additional, 30 in. and larger, usually $1 per ton less. *b* Extra strength ASTM C 200-44T. *c* 4-in. *d* SS361-A. *e* 30 in. *g* Culvert pipe. Reinforced, ASTM C76-41. *h* Reinforced. ASTM C75-41. *i* Reinforced. ASTM C76-37. *j* Centrispun. *k* Per 100 ft. *l* F.o.b. plant. *m* Truck delivery. *o* Listed price is based on LCL (no minimum). *p* Less than 5 ton loads, price per ft. *s* Discounts from standard list consumers carload prices. Base price approx. $200 per net ton. List prices per ft.: ¾ in., 8¼c.; ¾ in., 11¼c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76¼c.; 4 in., $1.09; 6 in., $1.92; 3 percent tax on transportation costs not included. *t* Within switching limits. *u* ASTM C13-40. *v* F.o.b. city *z* 2 ft. lengths. *y* 3 ft. lengths. *z* CESA A60-1941 specifications used. *aa* No standard specifications in Can. *bb* Freight allowed to destinations in city. *cc* Truck loads; f.o.b. plant, Newton. *dd* LCL, delivered, f.o.b. truck. ** Recent 20% emergency freight rate increment granted railroads on Jan. 5 not included.

WROUGHT IRON PIPE: List prices per ft. same as wrought steel pipe. Discount for Pittsburgh base. Butt weld —1 in. and 1¼ in. black, 34 galv., 16; 1½ in. black, 38 galv., 18½; 2 in. black, 37½ galv., 18. Lap weld —2½ in. to 3½ in. black, 31½ galv., 14½; 4½ in. to 8 in. black, 32½, galv., 17. Freight rates to destination to be added to name delivered price.



128,000 sq. ft. of 1 9/16" Cemesto provides insulation, interior finish, and great strength with light weight — applied as structural roof deck to the curved roof of Brunswig Drug Company's new plant, Los Angeles, California.

Architects:
Albert C. Martin & Associates

Better Building ...in Less Time at Lower Cost

Today, in dozens of big construction jobs across the country, alert architects are demonstrating their skill in coping with rising construction costs, by specifying a material that gives their clients better building...in less time...at lower cost—

CEMESTO REG. U. S. PAT. OFF. *The Multiple-Function Material*

WHAT IT IS... Cemesto is a rigid, insulating, fire- and moisture-resistant building board...composed of a Celotex cane fibre core surfaced on both sides with asbestos cement, bonded with a moistureproof bituminous adhesive.

WHAT IT DOES... Cemesto gives you a superior material for *sidewalls, roof decks,* and *interior partitions.* It combines high thermal insulation with great structural strength in an integrated wall unit that furnishes both interior and exterior finish and requires no painting.

YOU ARE INVITED to write us for details on Cemesto applications in which you are interested. In the meantime, you'll find complete specifications on Cemesto in Sweet's file.

THE CELOTEX CORPORATION, CHICAGO 3, ILLINOIS

LUMBER, TIMBER, PLYWOOD—PER M FT., B.M., CARLOAD LOTS F. O. B.

SHORT LEAF YELLOW PINE AND DOUGLAS FIR

All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face)

All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)

	1x6 s4s	1x8 s4s	2x4 s4s	2x6 s4s	2x8 s4s	2x10 s4s	3x12 Rgh	6x12 Rgh	12x12 Rgh
Atlanta	**$80.00**	**$82.00**	**$70.00**	**$70.00**	**$75.00**	**$76.00**	**$80.00**	.....	.....
	95.00	*95.00*	*96.50*	*96.50*	*96.50*	*96.50*	*87.50*	*$87.50*	*$87.50*
Baltimore	**96.00**	**96.00**	**96.00**	**95.00**	**100.00**	**104.00**	**115.00**	.....	.....
	106.00	*108.00*	*112.50*	*112.00*	*114.00*	*114.00*	*121.00*	*121.00*	*121.00*
Birmingham	**90.50**	**90.50**	**87.00**	**86.00**	**87.00**	**90.00**	**110.00**	.....	.....
	95.50	*95.50*	*92.00*	*91.00*	*92.00*	*95.00*	*114.00*	*102.00*	*105.00*
Boston	70.00[3]	72.00[3]	66.50[3]	68.50[3]	70.50[3]	74.50[3]	70.25[3]	.....	.....
	64.75i	*64.75i*	*62.75i*	*63.25i*	*62.75i*	*62.75i*	*60.50i*	*59.50i*	*59.50i*
Chicago ‡	**100.00**	**104.00**	**93.00**	**93.00**	**93.00**	**100.00**	**100.00**	.....	.....
‡	*105.00*	*108.00*	*100.00*	*100.00*	*100.00*	*105.00*	*105.00*	*105.00*	*105.00*
Cincinnati	**89.00**	**91.00**	**90.00**	**88.00**	**90.00**	**92.00**	.....	.....	.....
Cleveland *k*	**110.00**	**120.00**	**120.00**	**120.00**	**120.00**	**125.00**	**130.00**	.....	.....
k	*115.00*	*130.00*	*130.00*	*130.00*	*130.00*	*130.00*	*130.00*	*130.00*	*130.00*
Dallas	**71.00**	**71.00**	**61.00**	**59.00**	**61.00**	**66.00**	**80.00**	.....	.....
Denver	*101.00*	*100.00*	*96.50*	*96.50*	*94.00*	*95.50*	*97.00*	*104.50*	*103.50*
Detroit	**98.00**	**98.00**	**90.00**	**90.00**	**95.00**	**93.00**	**93.00**	.....	.....
	93.00	*93.00*	*92.00*	*92.00*	*93.00*	*95.00*	*100.00*	*100.00*	*105.00*
Kansas City *a*	**105.00**	**110.00**	**100.00**	**100.00**	**100.00**	**100.00**	.....	.....	.....
	105.00	*110.00*	*100.00*	*100.00*	*100.00*	*100.00*	*105.00*	*120.00*	*120.00*
Los Angeles *a*	*103.00*	*103.00*	*103.00*	*102.00*	*102.00*	*102.00*	*108.00*	*115.00*	*105.00*
Minneapolis ‡*b*	112.00[3]	112.00[3]	.....	.....	.....	.....	.....	.....	.....
‡*b*	*108.00*	*108.00*	*108.00*	*108.00*	*108.00*	*110.00*	*130.00*	*130.00*	*130.00*
Montreal *e*[3]	73.00	76.00	70.00	72.00	76.00	85.00	.....	.....	.....
	111.55	*111.55*	*111.55*	*111.55*	*111.55*	*111.55*	*120.00*	*87.00*	.....
New Orleans	**90.00**	**90.00**	**84.00**	**80.00**	**80.00**	**82.00**	**90.00**	.....	.....
	68.00	*68.00*	*70.00*	*67.00*	*67.00*	*67.00*	*71.00*	*90.00*	*110.00*
New York ‡	**115/120**	**115/120**	**Range from $105.00 to $110.00**				**130/135**	.....	.....
‡	.....	.....	*Range from $120.00 to $130.00*				.....	*120/130*	*120/130*
Philadelphia			**Range from $100.00 to $110.00**					.....	.....
			Range from $110.00 to $120.00						
Pittsburgh	**75.00**	**77.00**	**80.10**	**80.10**	**83.25**	**89.70**	**107.75**	.....	.....
	93.60	*93.60*	*83.00*	*83.00*	*87.00*	*91.00*	*110.00*	*116.00*	*118.00*
St. Louis ‡*j*	**110.00**	**110.00**	**115.00**	**109.00**	**110.00**	**113.00**	.....	.....	.....
‡*j*	*120.00*	*120.00*	*130.00*	*130.00*	*130.00*	*130.00*	*130.00*	*145.00*	*145.00*
San Francisco *d*	*76.50*	*76.50*	*76.50*	*76.50*	*76.50*	*74.50*	*74.00*	*74.00*	*74.00*
Seattle	*70.00i*	*70.00i*	*70.00i*	*70.00i*	*70.00i*	*70.00i*	*75.00i*	*75.00i*	*75.00i*

	Rail freight increment* (See note for base price)	
	LONG LEAF Y. P. Merchantable grade up to 20 ft. 2x12 Rgh	12x12 Rgh
	PLYWOOD ⅝"	¼"
Atlanta	.....	.....	$22.32	$27.24
Baltimore	.....	.....	.....	.....
	193.60	182.30	22.86	27.90
Birmingham	.....	.....	.....	.....
	120.00	117.50	21.78	26.58
Boston	.....	.....	.....	.....
	.....	.....	22.86	27.90
Chicago ‡	.....	.....	.....	.....
‡	125.00	125.00	18.72	22.80
Cincinnati	.....	.....	.....	.....
Cleveland *k*	100.00	135.00	21.78	26.58
k	130.00	130.00	22.20	27.12
Dallas	.....	.....	.....	.....
	72.00	80.00	18.72	22.80
Denver	.....	.....	13.92	16.98
Detroit	90.00	105.00	21.78	26.58
	.....	.....	.....	.....
Kansas City *a*	.....	.....	16.56	20.16
	.....	.....	.....	.....
Los Angeles *a*	.....	.....	13.38*gh*	16.26*gh*
Minneapolis ‡*b*	.....	.....	16.56	20.16
‡*b*	.....	.....	.....	.....
Montreal *e*[3]	.....	.....	.....	.....
	.....	.....	.....	.....
New Orleans	100.00	105.00	18.72	22.80
	.....	.....	.....	.....
New York ‡	175/200†	175/200†	22.86	27.90
‡	.....	.....	.....	.....
Philadelphia	150.00	150.00	22.86	27.90
	.....	.....	.....	.....
Pittsburgh	130.60	141.00	22.56	27.48
	.....	.....	.....	.....
St. Louis ‡*j*	.....	.....	18.72	22.80
‡*j*	.....	.....	.....	.....
San Francisco *d*	.....	.....	10.08*g*	12.30*g*
Seattle	.....	.....	.....	.....

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [3] Spruce. [4] Western Pine, No. 3 Common. [5] Norway Pine. ‡Delivered. *a* Yard prices. *b* Retail prices, less than CL. *c* 5 M ft. or less. *d* Sales through wholesale distribution yard (F.o.b. purchaser's truck or carrier, San Francisco paid). *e* Tax exempt. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* No. 1 common. *j* Delivered in 5000 ft. lots. *k* These are retail yard prices quoted per truckload in Greater Cleveland. Less 2% for cash. Truck lots.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on ¼", $174.00; on ½", $200.00. For other centers add rail freight increment from table on proper size. For oiling add $3.00; for edge sealing add $2.00; for resin sealing add $8.50.

* Freight rates include 20% emergency increase granted railroads on Jan. 5. †18 ft. and under.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS Discounts from jobbers list, Jan. 16, 1946 Single or Double Thickness A quality	B quality	EXPLOSIVES Per lb. 40% Ammonia Gelatin in 50 lb. cases delivered in 200 lb. lots*
Atlanta	76%	76%	$0.195
Baltimore	70–10%	71–10%	.195
Birmingham	68%	68%	.15
Boston	77%	78%	.195
Chicago	68%*e*	68%*e*	.195
Cincinnati	67&10%*g*	67&10%*g*	.195
Cleveland	67–10–10%	67–10–10–10%	.235
Dallas	67%*e*	68%*e*	.2075
Denver	68%	68%	.20
Detroit	77%	76%	.195
Kansas City	68–10%*g*	68–10%*g*	.20
Los Angeles	63%	68%*h*	.2025
Minneapolis	68%	68%	.20
Montreal	40–5%*ab*	40–10–5%*ab*	18.25*i*
New Orleans	68%	68%	.205
New York	73%	74%	.265*f*
Philadelphia	69%	70%	.195
Pittsburgh	70–10%	70–10%	.1675
St. Louis	70–10%	70–10%	.20
San Francisco	66%	73%	.20
Seattle	59%	60%	.2025

Price of 60% Ammonia Gelatin is $0.0125 per lb. higher than 40%

a Discount from list, Sept., 1939; **sales tax** included, but 6% tax exemption not allowable for. *b* Single thickness. *d* Discount from jobbers list Sept. 15, 1928. *e* Discount from list of Jan. 29, 1947. *f* In borough of Kings, Queens and Richmond, and in Manhattan south of Canal St., add delivery charge of $9.00 per trip. *g* Discount from list of Aug. 15, 1938. *h* Single thickness. Double thickness, 67%. *i* F.o.b. city, per 100 lb, forcite 40%; 60%, $20.00

* Urban prices influenced by service charges or local storage and delivery regulations do not consistently reflect quantity prices in less congested areas.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.15	$0.175	$0.195
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.155 –.1625	.18 –.1925	.20 –.2125
Rocky Mtn. States	.155 –.1675	.18 –.1975	.20 –.2175
Pacific N. W. States	.1525–.165	.1825–.195	.2025–.215
Pacific S. W. States	.15 –.1575	.18 –.1875	.20 –.21

PILES, TIES F. O. B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk.

Dimensions	Points	Length	By Rail Pine*	Fir
12-in. at butt	6-in.	30 to 50-ft.	$0.34	....
12-in. — 2-ft. from butt	6-in	50 to 59-ft.	.35	....
12-in. — 2-ft. from butt	6-in.	60 to 69-ft.	.36	....
12-in. — 2-ft. from butt	6-in.	90 to 100-ft.	....	.62
13-in. — 3-ft. from butt	5-in.	91 to 100-ft.	....	.63
14-in. — 2-ft. from butt	6-in.	50 to 69-ft.	.41	.70
14-in. — 2-ft. from butt	6-in.	70 to 79-ft.	.43	.64
14-in. — 2-ft. from butt	5-in	80 to 85-ft.	.54	.65
14-in. — 2-ft. from butt	5-in.	85 to 89-ft.	.57	.66
14-in. — 2-ft. from butt	5-in.	90 to 100-ft.	....	.70

* Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

Prices f.o.b. per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'/6" Untr.	7"x9"x8'/6" Tr.
Boston	Oak	$1.45	.....	$2.00	.....
	Pine	1.35	$3.05*a*	1.90	$4.00*a*
New York	S. L. Sap Pine	1.65	2.85	2.00	3.30
	Mixed Oak	1.80	3.05	2.50	3.60
Birmingham	Hardwood	1.00	1.60*a*	....	2.25*a*
Chicago	Red Oak	....	2.35/2.45*a*	....	3.25/3.40*a*
Los Angeles	Douglas Fir	1.86	2.82*a*	....	....
Philadelphia	Red Oak	2.25	3.05*ag*	3.00	4.15*ag*
St. Louis	White Oak	1.80	....	2.50	....
	Red Oak	....	2.40*a*	....	3.40*a*
	Sap Pine or Cypress	2.20	....	....	....
San Francisco	Douglas Fir	1.60*ef*	2.80*f*	2.10*bf*	3.88*caf*
Montreal	Birch or Maple	....*h*	....*h*	....*h*	....*h*

Tr.— Treated; Untr.— Untreated. *a* Creosoted. *b* 7" x 9" x 8'. *c* Empty cell. *e* Green. *f* F.o.b. cars. *g* January, 1943 price, none later available. *h* No constant price available.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder in drums f.o.b. works, per 100 lb.	$3.75
Chlorine cylinders, liquid, per lb. delivered	.07–.12
Calcium chloride, 77–80%, flaked, 100-lb. paper bag, del'd, ton	22.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	1.65
Soda ash, 58%, in paper bags, per 100 lb. dense	1.38
Sulphate of aluminum, commercial, in 100-lb. bags	1.15–1.30
Sulphate of copper, in bgs., per 100 lb.	7.60

RIGGERS' HAND BOOK FREE
Shows sling types, fittings, capacities. Write for your copy.

●PATENTS: U. S., 1475859, 1824671, 2142641, 2142642, 2299568; CANADIAN, 252874, 258068

Give us the "picture"... we'll fit your routine lift or special job with the correct YELLOW STRAND *BRAIDED* SLING*

It can be a blueprint, sketch or description. Given an accurate "picture" of your lifting problem, we will suggest a practical answer. And because it will be in the form of a Yellow Strand *Braided* Safety Sling, you'll get an efficient sling with these advantages: increased protection for men and loads, easy-to-manage flexibility, high kink-resistance, light weight.

Is the load slippery or awkward, requiring a choker grip? Should it be cradled in a basket hitch... picked up by the edges... hooked through eyebolts... kept level? For such recurring situations in factories, foundries, shops, utilities, warehouses and construction industries, there are numerous types of Yellow Strand *Braided* Slings. One may fit your case. But if you need an original sling—perhaps with spreader bar or special hooks—we'll design a custom job embodying the stamina of Yellow Strand Wire Rope and the time-saving features of the patented *braided* construction.

Send details of your application now and let B & B engineers offer a recommendation. Broderick & Bascom Rope Co., St. Louis 15, Mo. *Branches:* New York, Chicago, Houston, Portland, Seattle. *Factories:* St. Louis, Seattle, Peoria.

BRODERICK & BASCOM
Yellow Strand
BRAIDED SAFETY SLINGS

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME — DELIVERED

	STRUCTURAL CLAY TILE PARTITION — SCORED Per M, lots of 2,000 pieces or over.			STRUCTURAL CLAY TILE — LOAD BEARING — SCORED Per M, lots of 2,000 pieces or over.			BRICK Per M, in quantity		LIME Per ton, In paper, Carload lot		
	3x12x12 in.	4x12x12 in.	8x12x12 in.	8x12x12 in.	10x12x12 in.	12x12x12 in.	Common backing	Straight hard	Hydrated finishing	Common hydrated	Pulverized, or lump
Atlanta	.....	.....	.....	.....	.....	.....	$24.00	$24.00	$19.00	$17.50	$17.50
Baltimore	$120.00	$126.00	$220.00	$240.00	$315.00	$340.00	27.00*k*	32.00*k*	30.00	18.00	.....
Birmingham	97.50	104.00	195.00	231.00	.....	.....	20.00*f*	22.50*gg*	24.55	17.50	.....
Boston	105.00†	112.00†	210.00†	252.09†	.....	.....	20.00*k*	20.00*k*	21.00†	.....	16.00
Chicago	115.00	122.50	230.00	.....	.....	.....	20.00	21.00	25.00	18.00	.....
Cincinnati	120.00*j*	135.00*j*	170.00*jdd*	280.00*j*	.....	.....	33.00	33.00	25.60	23.20	.....
Cleveland	107.50*cc*	114.50*cc*	210.50*cc*	.....	.....	.....	25.50	25.50	21.15	19.15	23.25*ee*
Dallas	.....	83.00	.....	.....	.....	.....	18.00	20.00	28.00	22.00	.....
Denver	.....	.....	.....	.....	.....	.....	28.50	28.50	34.80*bb*	28.00*bb*	34.00*bb*
Detroit	130.00	145.00	260.00	300.00	380.00	443.00	27.00*f*	29.00*f*	28.00	26.00	26.00
Kansas City	115.00	120.00	190.00	250.00	.....	.....	24.75	26.75	34.00	30.00	30.00
Los Angeles	*r*	*r*	*r*	*r*	*r*	*r*	25.00	.....	33.20	33.20	27.00
Minneapolis	144.00*p*	160.00*p*	.....	160.00*ep*	.....	.....	23.50*p*	.....	33.00*bb*	24.00*bb*	33.00*bbdd*
Montreal	100.00*a*	110.00*a*	206.25*a*	151.50*aq*	.....	294.40*a*	24.00	35.00	12.50*ub*	14.00*ub*	18.45*a*
New Orleans	160.00	160.00	300.00	380.00	411.89	485.91	29.00	.....	30.00	20.00	
New York	103.90	110.80	152.35*c*	166.70*hn*	.....	.....	28.00	.....	34.00	25.00	.....
Philadelphia	112.10	119.60	224.20	269.10	321.20	405.10	24.75	27.75	26.75	17.00	17.00
Pittsburgh	98.50	105.80	181.85	217.30	265.85	303.10	26.00	31.00*q*	28.45	18.65	2.97*m*
St. Louis	113.00	118.00	220.00	231.50	275.00	.....	28.50*nl*	26.50*n*	.72*saap*	.55*saap*	.82*aaspee*
San Francisco	124.00	139.50	186.00*dd*	139.50*t*	.....	.....	27.50	.....	24.65	24.65	2.46*m*
Seattle	137.00*cc*	147.00*cc*	.....	147.00*ccw*	.....	.....	28.50*f*	33.50*n*	25.00*ubb*	25.00*ubb*	3.50*mubb*

† F.o.b. *a* Smooth. *b* Per 50 lb. bags. *c* 6 x 12 x 12 in.-3 cell. *d* Pulverized hot. *e* 5% discount for cash. *f* Includes $3.50 per M for truck delivery. *g* 5½ x 8 x 12. *h* F.o.b. trucks, job site N.Y.C. *i* F.o.b. warehouse only. *j* Truck load or over. *k* $1.00 discount. *l* Red face. *m* Per bbl., 180 lb. *n* 7⅝ x 7⅝ x 12. Speed title. *p* Truck lots. *r* Not used because of earthquake danger. *s* 2% discount for cash. *t* 5½ x 8 x 11½. *u* Tax exempt. *v* Sand lime. *w* 5 x 8 x 12. *y* Stacked. *z* Pebble lime price per 80 lb. sack. *aa* Price per sack. Lime not sold per ton. *bb* LCL. *cc* Truck delivery. *dd* 6 x 12 x 12. *ee* Pebble lime. *ff* 80% common. *gg* Select. *hh* LCL.

PAINT, ROOFING — F.O.B. CARLOAD LOTS

	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl.	WHITE LEAD Per 100 lb. in 100 lb. cases	READY-MIXED PAINT Per gal., drums			ROOFING SUPPLIES Carload lots f.o.b. factory				
	Dry *a*	In oil *w*	Graphite *b*	Aluminum *c*	Ferric Oxide *d*	Rolls, slate surfaced, 85-90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 360 lb. bbl. per ton
Atlanta	$18.85	$27.375	$1.75	$2.70	$1.65	$2.06‡	$2.06‡	$2.06‡	$1.00‡	$36.00‡
Baltimore	18.60	27.00	2.25	3.50	2.75	2.75	3.30	3.30	.55	33.00
Birmingham	18.85	27.375	4.40	4.52	....	3.05	3.00	3.00	.48	34.50
Boston	18.60	27.00	1.73	2.50	2.31	2.00‡*h*	3.30‡*g*	3.30‡*g*	.25‡	21.00
Chicago	18.60	27.00	....	....	....	2.78‡	2.91‡*o*	2.91‡*o*	34.00†*bb*	35.00‡
Cincinnati	18.60	27.00	....	3.15	1.90	2.21	2.26*o*	2.26*o*	37	34.00
Cleveland	18.60	27.00	3.00	3.00*a*	3.00	2.39	2.50*o*	2.50*o*	.32*y*	35.40
Dallas	18.60	27.00	....	4.05	....	2.69*q*	3.00*q*	3.15*q*	.90	45.00
Denver	18.60	27.50	2.88	4.38	2.63	3.17*o*	3.00*o*	.....	.39	40.00
Detroit	18.60	27.00	2.25	3.00	2.00	2.25	2.25	2.25	.50	25.00
Kansas City	18.60	27.125	3.30*g*	3.55*g*	3.16*g*	3.00	3.25	3.50	.54	31.00
Los Angeles	18.85	27.50	2.80	4.00	3.50	2.35	1.80*e*	*l*	.65	*l*
Minneapolis	18.60	26.13*m*	....	....	....	2.27*im*	2.38*him*	2.38*him*	.37*m*	30.00*m*
Montreal	.....	19.20	2.90*p*	4.20*p*	3.62*p*	3.14*t*	2.85*tf*	2.30*tf*	.68*t*	2.15*tt*
New York	18.60	27.00	3.45	....	3.45	2.28	2.38*o*	2.38*o*	.34*x*	30.00
Philadelphia	18.60	27.00	2.00	2.40	1.90	2.54	2.94	2.94	.37	26.00
Pittsburgh	18.60	27.00	2.00	2.90	1.90	2.93	3.00*o*	3.00*o*	.37	35.00
St. Louis	18.60	27.00	....	....	....	2.75	2.83	2.83	.40	33.00
San Francisco	18.85	27.25	1.80	2.75*n*	1.35	2.27*x*	3.30*ux*	.....	.38*y*	.....
Seattle	18.85	27.50	2.95*m*	2.95*m*	....	3.13*mqcc*	3.17*hmcc*	....	.49*mcc*	35.00*jm*

‡ Delivered. Note: Red lead in oil 50c higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* 15 lb per square. *f* Per 432 sq. ft. *g* 50 gal. drums. *h* Per roll, 65 lb. Minneapolis and vicinity. *j* Asphalt pitch. *k* Per cwt. *l* Not used. *m* 1% discount for cash. *n* May, 1941 price. *o* Per 60-lb. roll. *p* Tax included. *q* Per 90-lb. roll. *r* F.o.b. factory Chicago. *s* ASTM Spec. D266-41. *t* Federal tax included. *w* Price to large paint contractors is $1.25 less. *x* Mineral surfaced. *y* 55-gallon container. *z* Drums. *aa* Approximate cost per 100 lbs. *bb* Roofers coating and cement. Price per ton. *cc* LCL.

SKILLED AND COMMON WAGE RATES — PER HOUR

	Brick-layers	Car-penters	Struct. Iron Workers	Hoisting Engineers	Plas-terers	Electrical Workers	Steam-fitters	Common Labor Building	Common Labor Heavy Const.
Atlanta	$2.25	$1.65	$2.00	$2.00	$2.00	$2.00	$2.00	$0.75	$0.85
Baltimore	2.50	1.95	2.15	2.20/2.40	2.00	2.00	2.00	1.10	1.10
Birmingham	2.25	1.625	1.90	1.60/1.875	2.00	2.00	2.00	.85	.95
Boston	2.15	1.90	2.15	2.25	2.25	2.15	2.00	1.40	1.40
Chicago	2.20	2.15	2.20	2.15	2.225	2.15	2.15	1.50	1.50
Cincinnati	2.25	1.975	2.10	2.00	2.125	2.125	2.125	1.25	1.15
Cleveland	2.25	2.125	2.25	1.875/2.125	2.125	2.125	2.125	1.55	1.40
Dallas	2.25	1.875	2.00	2.00	2.125	2.00	2.125	.95	.95/1.50
Denver	2.25*b*	1.875	1.875*b*	1.875*b*	2.25	2.05	2.05	1.275	1.35
Detroit	2.25	2.025	2.25	2.25	2.25	2.25	2.165	1.425	1.425
Kansas City	2.25	1.90	2.05	1.90/2.125	2.25	2.15	2.125	1.35	1.40
Los Angeles	2.375	1.90	2.10	1.85	2.25	2.15	2.25	1.35	1.35
Minneapolis	2.075	1.80	2.00	1.85	2.25	2.06	2.00	1.30	1.30
New Orleans	1.9375	1.70	2.00	1.75	1.875	2.00	2.05	.90	.90
New York	2.75*b*	2.75*b*	3.00	3.00*b*	3.00*a*	2.50*a*	2.75*b*	1.50	1.50
Philadelphia	2.40/2.50	2.00	2.40	2.25	2.25	2.25	2.25	1.10	1.10
Pittsburgh	2.50	2.25	2.25	2.40	2.25	2.25	2.25	1.30	1.30
St. Louis	2.50	2.20	2.25	2.40	2.25	2.25	2.25	1.35	1.50
San Francisco	2.25	2.00	2.25	2.00	2.25	2.25	2.25	1.40	1.40
Seattle	2.365	2.065	2.265	2.20	2.365	2.265	2.34	1.665	1.50
Montreal*	1.40	1.06	1.11	1.00	1.17	1.11	1.11	.73	.67

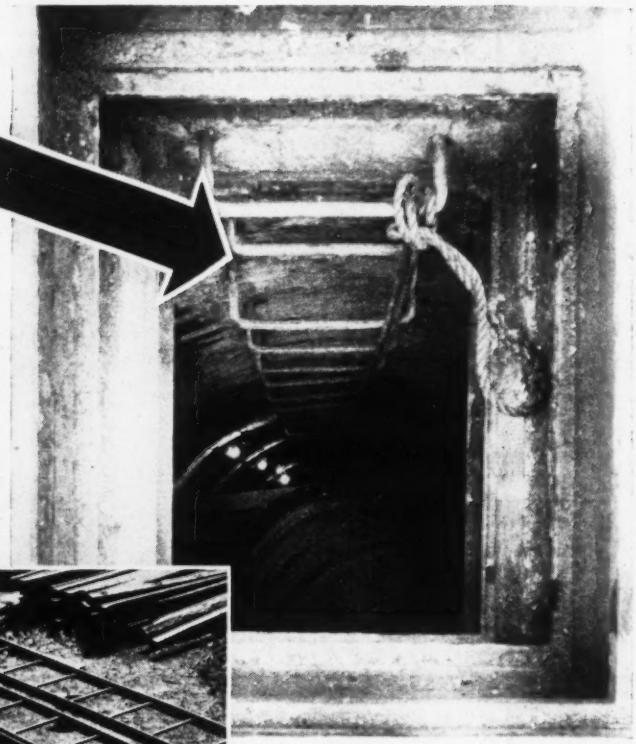
a 6 hr. day. *b* 7 hr. day. * Cost of living bonus now included in basic wage.

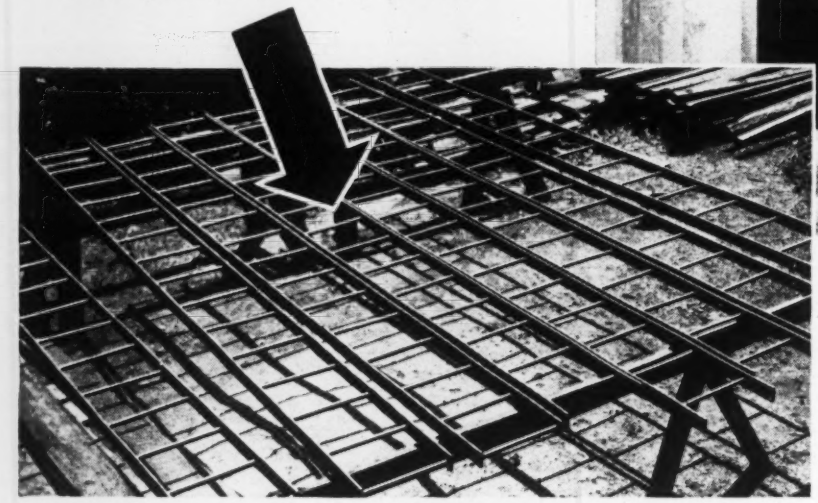
MEXICO CITY PRICES

In Pesos, f.o.b. City		Dec. '47	Jan. '48
Common Wages Building (8 hr. day)	av. per hr.	.57	.57
Common Wages Heavy Const. (8 hr. day)	av. per hr.	.75	.75
Skilled Labor Wages			
Carpenters (8 hr. day)	av. per hr.	1.25	1.25
Bricklayers (8 hr. day)	av. per hr.	1.25	1.25
Struct. Iron Workers (8 hr. day)	av. per hr.	1.50	1.50
Struct. Steel Shapes 3" 15" x 12 meters	per ton	800.00	800.00
Reinf. Steel, Corr. Rods ⅜" x 12 meters	per ton	1,000.00	1,000.00
½" x 12 meters	per ton	955.00	975.00
⅝" x 12 meters	per ton	940.00	940.00
¾" x 12 meters	per ton	940.00	940.00
⅞" x 12 meters	per ton	930.00	930.00
1" x 12 meters	per ton	925.00	925.00
Gravel, truck load of 3½ cu. meters			
Blue Gravel	per tr. load	33.00	32.00
Rose Gravel	per tr. load	32.00	30.00
Cement, Std. Port. (Toltecа)	per ton	115.00	115.00
Lumber			
Mex. Sacred Fir (Oyamel)	per M ft.	370.00	400.00
1st Class Pine	per M ft.	700.00	750.00
2nd Class Pine	per M ft.	500.00	500.00

ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $2.153. **ENR Common Average:** $1.272

These old Wrought Iron Rungs served 50 years SO These new Ladders are BYERS WROUGHT IRON





BYERS WROUGHT IRON
excels in these water works
and sewerage applications, too:
DIGESTOR COILS VENT STACKS
ROTARY DISTRIBUTOR ARMS
WEIR PLATES OUTFALL LINES
TRASH RACKS AND SCREENS
SLUDGE GAS LINES
COMPRESSED AIR LINES

When the Cleveland (O.) Water Department decided to replace some old ladders in their tunnel shafts, the records of the original wrought iron rungs provided a splendid guide in selecting the new material. The old rungs illustrated were installed in a 85-foot shaft, and had served for over 50 years. Primary reason for replacement was uneven spacing, which made for a dangerous condition; except for a few bottom members, the rungs were still in splendid condition. New ladders were fabricated from Byers Wrought Iron by Patterson-Leitch.

PROVEN ENDURANCE

Manhole ladder steps are one of the many applications in the waterworks and sanitary fields where wrought iron has proven its superior durability and over-all economy. Communities in all sections of the country have standardized on this reliable material, thereby reducing replacements, and eliminating a serious safety-hazard. Damp, humid atmospheres found in tunnels are death to ordinary metals . . . but meet their match in wrought iron.

THE WHY OF DURABILITY

Wrought iron's superior endurance comes from its unique composition and structure. Tiny fibers of glass-like silicate slag, threaded through the body of high purity iron, halt and "detour" corrosive attack, discouraging local pitting. The fibers also help anchor the initial protective scale, which shields the underlying metal.

SEND FOR BULLETIN

Our bulletin, "Wrought Iron for Sewage Treatment and Disposal Installations", gives helpful information on the current use and record of wrought iron manhole ladder steps. A complimentary copy will be sent on request.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N.Y.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

New Aids to the Constructor

MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

(Number refers to item directly below it)

57

CRUSHING AND SCREENING PLANT —No. 55 model is compact semi-portable hopper-fed plant, consisting of jaw crusher, bucket elevator and transfer conveyor mounted on four-wheel trailer. Revolving screen is complete unit easily mounted on either steel or wood bin. Jaw crusher is available in two standard sizes—1016 which produces 10 to 15 tons per hour at 1½-in.

setting and 1024 which produces 15 to 25 tons per hour. With 1016 crusher and bin, plant weighs about 26,000 lb. The 50-continuous horsepower gasoline or diesel power unit is mounted between crusher and bucket elevator. For transit, bucket elevator lowered by hand winch folds back over truck, reducing travel height to 11½ ft.—*Pioneer Engineering Works, Minneapolis* 13, *Minn.*

58

EXCAVATOR — Type 5⅜-cu. yd. unit is available as shovel, dragline, clamshell, crane and hoe and is readily interchanged from one class to another. All main operating machinery is positioned on welded deck, proportioned to take all strains and stresses set up in

operation. It may be powered with gasoline or diesel engine. Twin Disc clutches activate swing, travel and hoisting motions. All controls are grouped around operator. Cab is designed to give full view of work and complete weather protection. Racking on drums on boom have been eliminated and ropes are arranged to give direct, positive, independent crowding action, which allows shallow cuts and holding to grade.—*Osgood Co., Marion, Ohio.*

59

DIESEL ENGINE—Known as Sturdy Scot, new single-cylinder, vertical four-cycle, stationary diesel engine has bore of 5¾ in. and 7½-in. stroke. Horsepower is 10 at 600 rpm., 12 at 720, and 14 at 800. The 3¾-in. dia. crankshaft is carried on two Timken roller main bearings; piston is 9⅛ in. long and carries five rings.—*Lorimer Diesel Engine Co., 16th & Wood Sts., Oakland 7, Calif.*

60

READY-MIXED CONCRETE TRUCKS —Complete line of FWD trucks is available for use with every standard type of transit concrete mixer. For 2-yd. mixer, standard HR truck is recommended. Two models are available for

3-yd. mixers: HA truck equipped with auxiliary rear axle for weight carrying ability and standard Model SU. For 4½-yd. mixers are offered Model M7 or Model HR equipped with auxiliary rear axle. Recommended for 5½-yd. mixer are M10 or SU with auxiliary rear axle.—*Four Wheel Drive Auto Co., Clintonville, Wis.*

61

TAIL GATE LOADER—Lift platform of new truck loader operates over full distance from ground to truck floor level, raising and lowering loads up to 1200 lb. Platform remains level throughout entire travel arc and swings up to serve as tail gate when truck is on road.

Hydraulic pump is driven from trucks standard power take-off and controlled by convenient lever or pump can be hand-operated. Unit, which fits most standard 1½-ton trucks, is furnished in complete package and takes only few minutes to install.—*Day Co., 306 W. 69th St., Chicago* 21, *Ill.*

62

ENGINE HEATER—Superfex heater can be installed on almost all types of motor power. By utilizing heat from exhaust gases and by adding hot air or external liquid heat exchanger, heat

IF YOU WANT MORE INFORMATION on new products or manufacturers' publications, mark the identifying item numbers on the coupon below, and mail. No cost or obligation to you.

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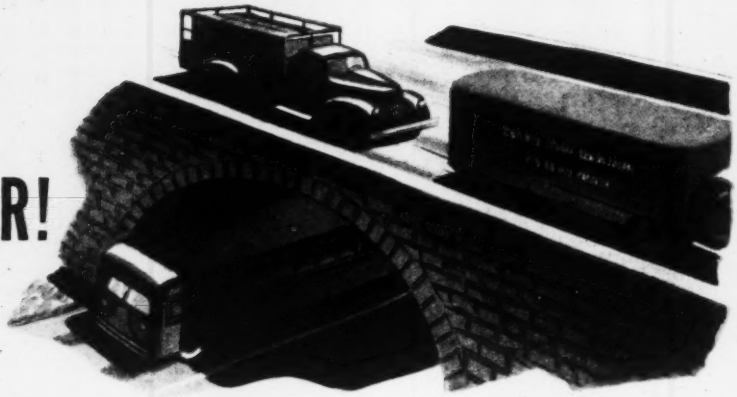
IT LUBRICATES BETTER–LONGER!

IT KEEPS ENGINES CLEANER!



IT'S QUAKER STATE HD OIL

The longer you work with trucks and buses, the more you realize that most engine troubles are caused by:

a. Wear of working surfaces

b. Clogging deposits on working surfaces

That is why a modern lubricant for truck and bus engines must perform two functions well.

1. It must combat wear effectively by doing a better, more lasting lubricating job.

2. It must prevent "dirt," in the form of sludge, gum and sticky "varnish," from being deposited on engine working surfaces.

Quaker State HD Oil is made especially to do this double-duty job under the severe conditions usually encountered in truck and bus service.

It is a real "double-duty" oil that not only *lubricates* but *cleans* engines—helps keep them in better shape with less servicing. It will pay you to prove these facts by trying Quaker State HD Oil in your equipment.

QUAKER STATE HD OIL AND SUPERFINE LUBRICANTS

- *Use Quaker State HD Oil for trucks, buses, taxis, tractors.*
- *Use Quaker State Motor Oil for passenger cars.*

QUAKER STATE OIL REFINING CORPORATION • OIL CITY, PENNSYLVANIA

look to...

P&H

for added values

Wherever you find the P&H Model 1055 on the job, you'll hear owners singing its praises for the new Magnetorque swing which marks the end of swing friction trouble and costly maintenance.

No Friction . . . No Friction Problems

The new Magnetorque solves the problems of old style swing clutches . . . by completely eliminating friction.

Without mechanical linkage . . . without friction . . . without wear — the Magnetorque transmits power for both swing and propel motions — and does it better.

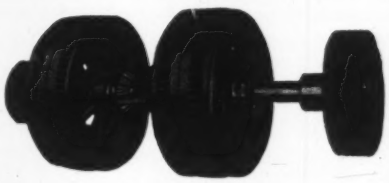
Makes Production Purr

Because it's smoother, faster, more responsive . . . because it permits quicker, more accurate stops and starts — the Magnetorque swing cuts wasted operating time, increases daily production and lowers yardage costs.

The Swing of a Lifetime

The Magnetorque is built to last the life of the machine. And during this time not so much as a single hour will be required for its repair, replacement, or maintenance.

It's one of the most important improvements in the past twenty-five years . . . users all over the country say so . . . performance has proved it. Write for complete information.



The New P&H Magnetorque Swing

Power for swing and propel transmitted by electro-magnetic forces. Operated by small generator on main engine; controlled from operator's station. Swing motions, slow or fast, have cushioned acceleration and deceleration. Because there is no friction swing, there are no friction problems. One more in the long list of P&H Added Values.

P&H

EXCAVATORS

4404 West National Avenue
Milwaukee 14, Wisconsin

HARNISCHFEGER
CORPORATION

EXCAVATORS · ELECTRIC CRANES · ARC WELDERS · P&H · HOISTS · WELDING ELECTRODES · MOTORS

What Price Freezing?

PROTECT AGAINST TIME LOSS BY:

SPACE HEATING of temporary buildings, storage sheds, repair shops, buildings under construction.

PREHEATING engines and all kinds of mechanical equipment.

SPOT HEATING of materials, workmen, machinery, storage tanks, tools.

THAWING frozen areas and machinery, wheels, gears, transmissions, caterpillars, etc.

DRYING and curing of materials, plaster, paint, mortar, concrete, etc.

VENTILATING and heating of manholes, tunnels, box cars, ship holds, confined areas of all kinds.

KEEP GOING THIS WINTER WITH HERMAN NELSON PORTABLE HEATERS!

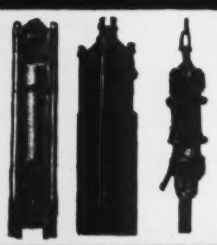
Let it Snow! Let it Freeze! Here's quick, clean, safe HEAT . . . to combat damp and icy weather on any job. Herman Nelson Portable Heaters protect men, machinery and materials. It's protection you can't afford to overlook — protection against time loss! Why gamble needlessly when, with Herman Nelson Portable Heaters at work, you can get HEAT, lots of it—where you want it, when you want it — without waste. This efficient unit is no bigger than a kitchen stove, yet produces enough heat for three ordinary 5-room houses. And it's all done without smoke, soot or open flame!

Write for Interesting, Free Booklet on "Cost Control"

THE HERMAN NELSON CORPORATION MOLINE ILLINOIS

SINCE 1906 MANUFACTURERS OF QUALITY HEATING AND VENTILATING PRODUCTS

McKiernan-Terry



PILE HAMMERS and EXTRACTORS

Now made in sizes of complete, standardized line of ten double-acting hammers, five single-acting hammers and two double-acting extractors. Write us for free descriptive Bulletins 55 and 57.

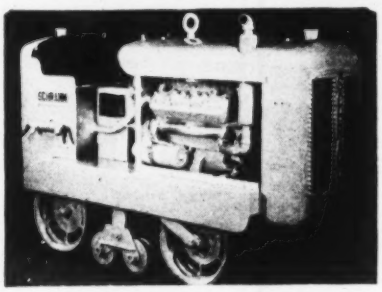
MK-237

McKIERNAN-TERRY CORPORATION MANUFACTURING ENGINEERS 13 PARK ROW, NEW YORK 7, N. Y.

generated serves to warm oil, battery, cab, cargo and other valuable parts of equipment. An auxiliary heater, it operates independently of engine. These heaters are furnished for either completely-automatic, thermostatically-controlled operation or for varying degrees of operator control. They come equipped with steel heat exchanger for coolant circulation, operating with thermo-syphon head. They are small enough to permit mounting on automotive equipment, usually under hood in engine compartment.—*Perfection Stove Co., Cleveland, Ohio.*

63

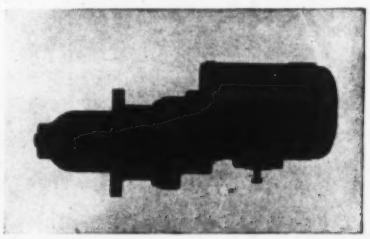
CRAWLER-MOUNTED AIR COMPRESSOR—No. 60 crawler is 88 in. long, including draw-bar, 32⅞ in. wide and 51½ in. high. It weighs 2,600 lb. Equipped with rubber tracks, heavily reinforced with steel wire, it will climb



any hill on which surface does not slide. Steering is by hydraulic brakes on driving wheels. It can reach speed of 20 mph. Besides operating pneumatic tools and other attachment, tractor feature lends itself to towing, climbing and pushing.—*Schramm, Inc., West Chester, Pa.*

64

AIR STARTER—This 7-hp. air motor with Bendix starting drive easily handles diesel engines up to 600-cu. in. displacement. Unit is 18 in. long and



5½ in. in diameter and can be mounted on any diesel by means of SAE No. 2 flange.—*Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.*

65

BULLDOZER—Straight and angle dozers, available for D4 and D6 Caterpillar tractors, incorporate fluid power control provided by LaPlant-Choate hydraulic pump. D4 models are track

for lowest first cost...

and HIGHEST YARDAGE PER HOUR on your small earthmoving jobs

you can't beat LAPLANT-CHOATE

4-yd. hydraulic operated scrapers and high speed, rubber-tired industrial tractors . . . .

LaPlant-Choate 4-yd. scrapers have all the features for moving more dirt at less cost. Offset cutting edge and powerful hydraulic down pressure insure instant penetration in any type of material and 25% faster loading. Positive forced ejection means fast, accurate spreading. Modern design and low center of gravity provide maximum maneuverability and minimum maintenance and upkeep expense.

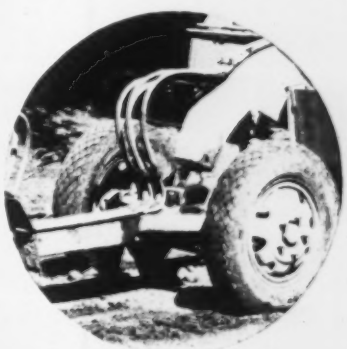
You can use these handy 4-yd. units with almost any type of industrial rubber-tired tractor with sufficient horsepower. They will pay for themselves and the tractor in a hurry and step up your profit range on an infinite variety of earthmoving jobs.

Ask your nearest LaPlant-Choate distributor for a copy of Bulletin A-1142-A for specifications. LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa; 1022 77th Avenue, Oakland 3, Calif.

COMPARE THE COST AND PRODUCTION

No. of Units	Approx. Cost Tractor & Scraper	*Production in Yds. Per Hour One Way Haul 200'	400'	600'	1000'	2000'
1	$ 6,500	69	55	50	44	32
2	13,000	138	110	100	88	64
3	19,500	207	165	150	132	96

*Production based on 50 minutes per hour operating efficiency, level loading, average working conditions and average material.



Easily converted for use with track-type tractors.

LAPLANT CHOATE

HIGH SPEED EARTHMOVING EQUIPMENT

FOR LOWEST POSSIBLE COST PER YARD..PER JOB..PER YEAR

Worthington-Ransome Blue Brute Distributors

See ad on page 115 for list of equipment in each line

Worthington-Ransome Distributors

Ala., Birmingham, Ragsdale Mach. Co., Inc.
Alaska, Anchorage, Airport Mach. & Storage Co.
Ariz., Phoenix, Lee Redman Equipment Co.
Ark., Fort Smith, R. A. Young & Son
Little Rock, R. A. Young & Son

Calif., Richmond, Bay Equip. Co.
Cal., L. A. Golden State Equip. Co.
Colo., Denver, Power Equipment Co.
Conn., Wallingford, Wilhelm-Davies Co., Inc.

Fla., Gainesville, Constr. Equip. & Supply Co., Inc.
Miami, Allied Equip. Inc.
Orlando, Highway Equipment and Supply Co.
Tampa, Emerson & Company

Ga., Atlanta, Tractor & Machinery Company

Ida., Boise, Olson Manufacturing Co.
Ill., Chicago, Thomas Hoist Co.
Iowa, Cedar Rapids, McNall Mach. & Supply Corp.

Kansas, Topeka, M. B. Salisbury Co.
Ky., Harlan, Crousborn Equip. & Supply Co.
Louisville, Williams Tractor Co.

Maine, South Portland, N. A. Burkitt, Inc.
Mich., South Muskegon, Lakeshore Machy. & Supply Co. Inc.
Mich., Detroit, W. H. Anderson Co., Inc.
Minn., Minneapolis, Phillippl Murphy Equip. Co.
Mass., Cambridge, Field Machy. Co.
Mass., West Springfield, E. F. Edson Co., Inc.
Miss., Jackson, Jackson Road Equip. Co.
Md., Baltimore, Paving Supply & Equip. Co.
Md., Salisbury, Paving Supply & Equip. Co.
Mo., Clayton, The Howard Corporation
Mo., Kansas City, Machinery & Supplies Co., Inc.
Montana, Billings, Interstate Truck & Equip. Co.
Helena, Caird Eng. Works
Montana, Missoula, Miller Machinery Co.

Nevada, Elko, C. W. Paul Hardware and Machy. Co.
N. Hampshire, Manchester, R. C. Hazelton Co., Inc.
N. J., No. Bergen, American Air Comp. Corp.
N. M., Albuquerque, Bud Fisher Co.
Roswell, Smith Machy. Co.
N. Y., Albany, Milton-Hale Machinery Co.
N. Y., Buffalo, Murray Equip. Co.
New York, Hodge & Hammond, Inc.
Syracuse, Milton-Hale Mach. Co.
N. C., High Point, Smith Equip. Co.
N. D., Fargo, Smith, Inc.

Ohio, Cincinnati, Carroll-Edwards & Co.
Dayton, Carroll-Edwards & Co.
Toledo, The Kilcorse Machy. Co.
Okla., Oklahoma City, Tattan-Douglas Equip. Co.
Oregon, Portland, Andrews Machinery

Pa., Wilkes-Barre, Ensminger & Co.
Mechanicsburg, American Equip. Corp.
Philadelphia, Metalweld, Inc.

S. C., Columbia, Smith Equipment Co.

Tenn., Chattanooga, Dempster Bros., Inc.
Tenn., Knoxville, Dempster Bros., Inc.
Memphis, Hamilton Tractor Co.
Nashville, Dempster Bros., Inc.
Tex., Amarillo, T. W. Carpenter Equip. Co.
Abilene, W. T. McClure Mach. Co.
Dallas, Shaw Equip. Co.
Houston, So. Texas Equip. Co., Inc.
San Antonio, Patten Machy. Co.
Tyler, D. M. McClure Equip. Co.

Utah, Salt Lake City, J. K. Wheeler Mach. Co.

Vt., Barre, A. M. Flanders, Inc.
Va., Richmond, Highways Machy. and Supply Co.

W. Va., South Charleston, Allied Equip. Co.
Wash., D. C., Paving Supply & Equip. Co.
Wash., Seattle, Star Machy. Co.
Wash., Spokane, Star Machy. Co.
Wash., Yokima, Star Machy. Co.
Wisc., Milwaukee, Drott Tractor Co., Inc.

Ransome Distributors

La., New Orleans, Ole K. Olson Co.

N. Y., Rochester, B-G Equip. Co.
O., Cleveland, H. B. Fuller Equip. Co.
Pa., Pittsburgh, Arrow Supply Company.

Worthington Distributors

Ind., Indianapolis, Reid-Holcomb Company

La., New Orleans, Wm. F. Surgi Equip. Co.

Md., Baltimore, D. C. Elphinstone, Inc.

O., Cleveland, Gibson-Stewart Co.
O., Columbus, Gibson-Stewart Co.

Pa., Allentown, H. N. Crowder, Jr., Inc.
Pittsburgh, Atlas Equip. Corp.

Texas, El Paso, Equip. Supply Co.
Wyoming, Cheyenne, Wilson Equip. & Supply Co.

BUY BLUE BRUTES

Worthington Pump and Machinery Corp

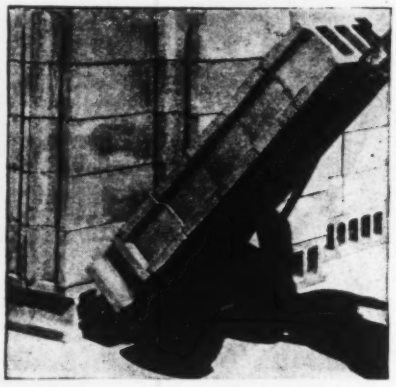
Worthington-Ransome Construction Equipment Division

Holyoke, Massachusetts

mounted, direct-lift, double-acting units with full-floating trunnion rams and positive down pressure. D6 dozer is frame mounted and incorporates new compact pump with minimum of hydraulic piping. Rigid frame with floating moldboard provides great strength, offset pivot pin for clearance, easy removal of main frame and blade, reversible cutting edge, correct and proved blade curvature.—*Wm. Bros Boiler & Mfg. Co., Minneapolis, Minn.*

66

HAND TRUCK—Hand truck with forks will pick up and transport six concrete blocks at time. With one block used



as pallet, other materials can also be handled by Block-Man.—*R. S. Reed Corp., East Hoffman St., Three Rivers, Mich.*

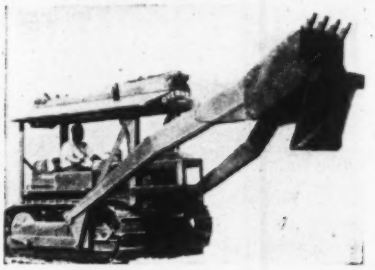
67

SOCKET WRENCHES—Torpedo-shape grips of Nugget double-duty drive socket wrenches are devoid of all knurling except for two decorative red bands. Balance of grip and handle is smooth, polished chromium plate. This

is said to give mechanic better grip because his hand fits shape. Absence of knurling makes handles easier to clean. These wrenches are now available in 49K set, which contains 49 wrenches weighing only 12 lb., 2 oz. Metal chest is bullet-shaped and has wheels and skids for moving. Hinged lid, when open, serves as receptacle for parts.—*Blackhawk Mfg. Co., Milwaukee* 1, *Wis.*

68

OVERHEAD SHOVEL — Sargent overhead shovel is now available for International T-9 and TD-9 crawler tractors,



as well as for Oliver Cletrac track tractors. Attachments can convert unit into anglegrader, backhoe or snow loader.—*Maine Steel, Inc., South Windham, Me.*

69

TILT TRAILERS — Two new tilt-type trailers are available for transporting tractors, rollers, compressors, shovel-loaders, mixers, etc. Model JT-408 has capacity of 8 tons and entire load is carried on tandem axle with four wheels and tires. Model JT-205 has single axle and capacity of five tons. Both models are perfectly balanced so one man can raise or lower the platform. Platform is so designed that load smay be shifted to transfer any desired weight to rear of truck when greater traction is required. Positive automatic safetly lock holds platform in position when loaded or empty. Rubber-mounted drawbar absorbs road shocks. —*C. R. Jahn Co., Savanna, Ill.*

70

ROOT RAKE—Manufactured in sizes to match Caterpillar diesel D6, D7 and D8 track-type tractors, Fleco root rake disposes of top growth and roots in single operation for land clearing. Basic frame consists of heavy steel angle iron across top of rake and heavy steel boxed section at center with brack-

ets attached to fit bulldozer arms or C frame. Cast steel teeth are interchangeable. Tooth points can be lowered 16 in. into ground to rake out roots. Company also produces detachable stumper, alloy steel casting designed for attachment to frame of angling blade bulldozers. — Made by *Florida Land Clearing Equipment Co., Jacksonville, Fla.* and merchandised by *Caterpillar Tractor Co., Peoria* 8, *Ill.*

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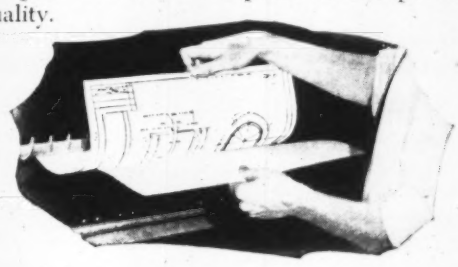

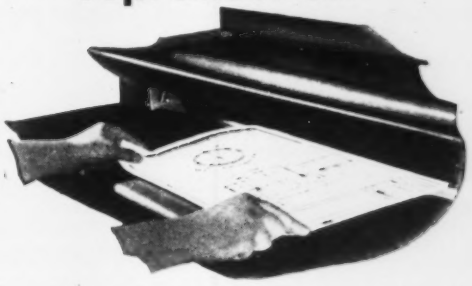

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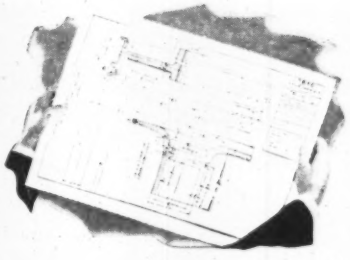

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67

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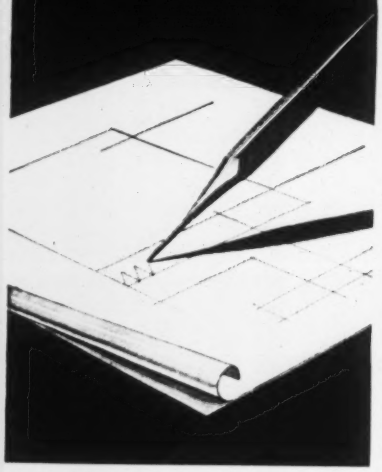

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Manufacturers' Publications

71

Lift Trucks—(Portfolio) Features illustrations, engineer's drawings, complete specifications and operating data on all models of Towmotor fork lift trucks and industrial tractors.—*Towmotor Corp., 1226 E. 152nd St., Cleveland 10, Ohio.*

72

Portable Gravel Plant—(Illustrated folder) Describes new TwinDual master, complete three-stage crushing, screening and loading plant in single unit. Specifications and flow chart are included.—*Universal Engineering Corp., Cedar Rapids, Iowa.*

73

Broadcasting Transmitter Buildings—(60-p. magazine article) Major portion of issue No. 9 of Western Electric Oscillator summarizes objectives and factors necessary for good transmitter building design. Suggested procedures, examples of present-day construction and suggestions of future trends are offered.—*Western Electric Co., Inc., 195 Broadway, New York 7, N. Y.*

74

Earthmovers—(12-p. bulletin) Describes operation and construction features of Terra-Cobra high-speed self-propelled earthmovers. On-the-job photos are included.—*Woodridge Mfg. Co., Sunnyvale, Calif.*

75

Vibration Mounts—(8-p. bulletin) Describes Rexon mounts, which feature high vibration dampening properties of rubber loaded in shear.—*Hamilton Kent Mfg. Co., Kent, Ohio.*

76

V-Belt Drives—(144-p. book) Furnishes full information in text, photographs, drawings and tables on selection of sheaves and V-belts for motors from 1 to 150 hp. to produce desired driven speeds. Also available is 8-p. bulletin describing equipment for metal industries, 6-p. folder on new HD-19 torque converter tractor, and 8-p. bulletin on automatic, self-priming pump.—*Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.*

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We'd like to make this offer to every executive in the building industry. The next time you want to make a business trip, will you let us fly you there in the 1948 *Ryan Navion*—absolutely FREE?

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2002 Lindbergh Field, San Diego 12, Calif.

77

Protective Coatings — (12-p. catalog) Gives complete details on chemical and physical properties, application instructions and other pertinent data on protective coatings. — *Amercoat Division, American Pipe & Construction Co., P. O. Box 3428, Terminal Annex 54, Calif.*

78

Screed Supports — (12-p. booklet) Illustrates and describes Adjustable screed supports, with pictures of typical installations. Supports for screeding any type of concrete slab are included. —*Adjustable Screed Co., Niles Hill Rd., Waterford, Conn.*

79

Truck Mixer — (4-p. booklet) Describes Hi-Boy Trukmixer, new high-discharge type unit. It includes service and construction views and gives specification data and operating information. —*Blaw-Knox Co., Pittsburgh, Pa.*

80

Locomotive Crane — (16-p. catalog) Gives full details and specifications on new Dieselectric locomotive crane with 40-ton capacity. Included are on-the-job pictures and summary of features. —*American Hoist & Derrick Co., St. Paul 1, Minn.*

81

Carbide Products — (65-p. catalog) Shows standard cemented carbide products, with specifications and prices. A 12-p. section is devoted to wear resistance applications. Small line sketches show typical applications of standard carbide tools and suggested uses for various shapes of standard carbide blanks.—*Carboloy Co., Inc., Detroit 32, Mich.*

82

Low-Bed Trailers—(18-p. bulletin) Lists advantages of Olson low-bed trailers. Matching doilies are also described.—*Olson Mfg. Co., Boise, Ida.*

83

Sewer Cleaning Tools—(16-p. catalog) Covers latest advancements in sewer cleaning equipment, including electric power cleaners, plumbers' sets, rod tools or cutting heads, rod couplings, adaptors, snakes, snake guns, snake houses and closet augers. — *Plumbers' Tool Division, Flexible Sewer-Rod Equipment Co., 9059 Venice Blvd., Los Angeles 34, Calif.*

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DECAY TERMITE Protected WITH PENTACHLOROPHENOL

Now there's a *clean* preservative for wood that stops decay and termites. It's Pentachlorophenol. Even under severe exposure conditions this great advance in wood preservation gives lasting, *tested* protection. You build for permanence indoors or out with clean "Penta" treated lumber, yet enjoy all the economy, convenience, and salvage value of wood construction. Pentachlorophenol is applied at low concentrations in petroleum oils by established pressure and non-pressure treating methods. It's effectiveness assures quick return of its low cost.

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Here's a case where Old Man Weather plotted against contractor Chet M. Herringer of Minneapolis. Unusually heavy rains and cold held up this 6000 yard excavation job until it was far behind schedule. But there was one thing Old Man Weather forgot — Chet Herringer's TRAXCAVATORS.

Chet put two of his one-yard Model IT4's on this job. Their direct-digging action, backed up with surefooted "Caterpillar" D4 tractor power, dug and loaded the wet, sticky clay and hardpan at a rate of 150 cubic yards an hour!

TRAXCAVATORS get work done! Put them to work digging, grading, excavating, loading and watch your hourly production climb. Their proven ability to do *more work* on *more jobs* on *more days* of the year means low-cost performance and greater profit for you.

TRAXCAVATORS are available in four sizes with bucket capacities from ½ to 4 cubic yards. See your TRACKSON-"Caterpillar" dealer for profit-making ways you can use one or more of these rugged versatile machines in your work or write TRACKSON COMPANY, Dept. EN-117, Milwaukee 1, Wis.

TRAXCAVATOR

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The Original Tractor Excavator

Men and Jobs

Alfred V. Perthou, Seattle, Wash., is general manager and partner of the U. S. Appraisal Co., a West Coast valuation and consulting engineering firm. Mr. Perthou is a graduate in engineering of Cornell University, and received his masters degree in economics from New School, New York City. He was one of the organizers of U. S. Appraisal.

C. Ray Kimball has been named acting city engineer at Ogden, Utah, succeeding Win Templeton, who resigned to enter private engineering in Salt Lake City.

Leslie Williams and **Charles M. Upham, Jr.**, have established Williams & Upham at 292 Madison Ave., New York 17, N. Y., to give advisory service on traffic and city planning problems.

Edward R. Murphy, former assistant chief engineer with the Gypsum Association, Chicago, Ill. is now managing director of the Vermiculite Research Institute in Evanston, Ill. Calvin Yuill, appointed building code engineer for the Gypsum Association, has taken over the building code work formerly handled by Mr. Murphy.

Howard B. Colby formerly of War Assets Administration, Office of Asquisition (Region, N. Y.) has been confirmed as superintendent of road construction with Atkinson-Drake-Park on a government contract in Greece, with headquarters at Athens.

Paul L. Holland, chief engineer of the Maryland Public Service Commission, has been appointed municipal director of public works at Baltimore by Mayor Thomas D'Alesandro. The appointment, subject to confirmation by the city council, already has the approval of a group of leading local engineers consulted by the mayor. Mr. Holland has been chief engineer of the P.S.C. since April, 1931. Other appointments sent by Mayor D'Alesandro to council were **Edward F. Shea** to succeed Edgar D. Marine on the Port Development Commission and **Rudolph Behounek** to succeed J. Edward Adkins, Jr., on the Port Development Commission.

When you're faced with shortages, need equipment parts, or must ship finished products to meet contract dates — use the speed and handiness of Air Express and your worries are over. Air Express is the fastest possible way to ship or receive; cuts days off shipping time.

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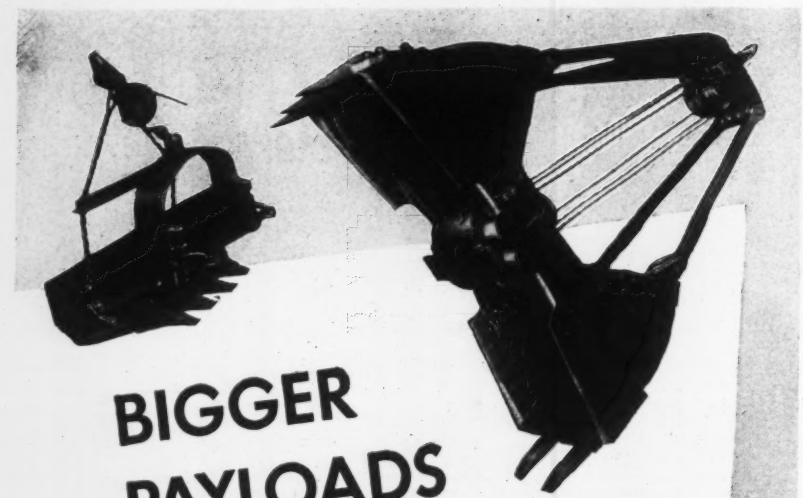

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Richard C. Stewart, formerly chief of the mechanical equipment branch of the Engineer Board, Fort Belvoir, Va., is returning to Ft. Belvoir as civilian technician with the reconstituted board. For the last year he has administered industrial research contracts for the Office of Technical Services of the Department of Commerce. Mr. Stewart, who is a civil engineering graduate of the University of Missouri, for several years before the war had his own contracting firm, engaging in highway and earthwork in Kentucky and Indiana.

Winifred W. DeMay has been named assistant city engineer of Hartford, Conn. He has been with the engineering department since 1916. He was named head of the survey division in 1938.

Albert D. M. Lewis, field engineer of the Gulf Oil Corp., Pittsburgh, Pa., is working on new construction in the Cincinnati, Ohio, refinery of the Gulf Refining Co. A civil engineering graduate of Purdue, 1941, he was in the Navy for two years and has been employed by the M. W. Kellogg Co., New York City, on various oil refinery construction projects, including work for the Texas Co. and the Standard Oil Co. of Indiana at Casper, Wyo.

Don Gilbert has been named city engineer at Angola, Ind.

E. D. Canatasey has been named city engineer at Martinsville, Ind.

E. F. Gillies, a graduate of Manitoba University and formerly engineer for the International Nickel Corp. at Copper Cliff, Ont., has been named traffic engineer of Winnipeg, Man.

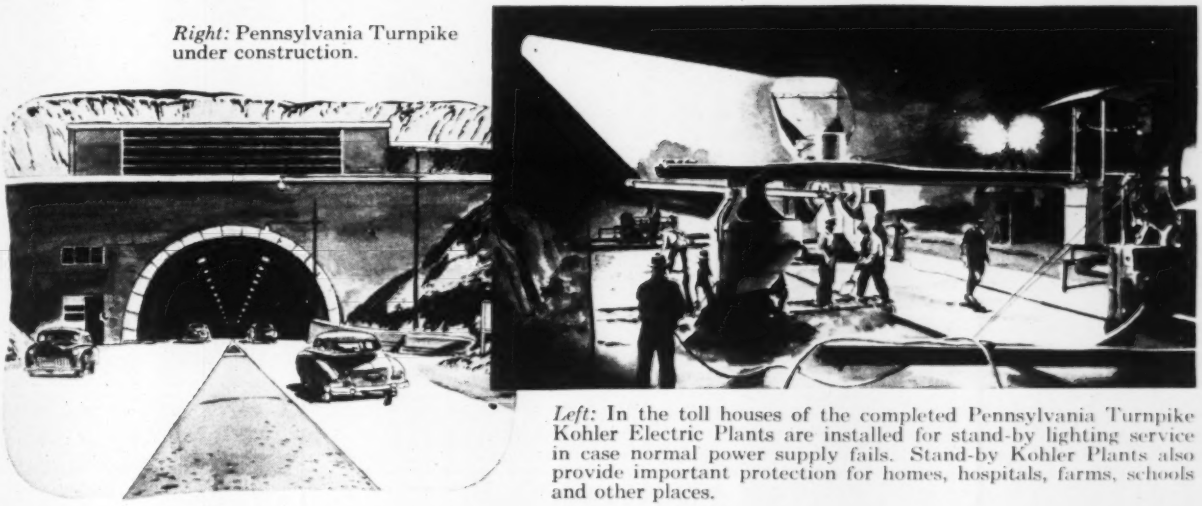
Henry H. Morgan of Indianapolis, Ind., has been employed to formulate a master plan for Kokomo, Ind., under new zoning laws.

Clifford L. Mutch, with the Bureau of Reclamation since 1926, has been named construction engineer of the Medicine Creek Dam, part of the Frenchman-Cambridge unit of the Missouri River Basin plan. Contract for the dam at $4,270,000 has been awarded to Lytle and Amis Co.

Fred W. Sawtelle, who is retiring after serving 27 years in various state departments in Wisconsin, has been appointed city engineer of Algoma, Wash.

Earl Condor, veteran employee of the Provo, Utah, city engineering department, recently was appointed to head the department as city engineer, succeeding Thomas H. Latimer, Jr.

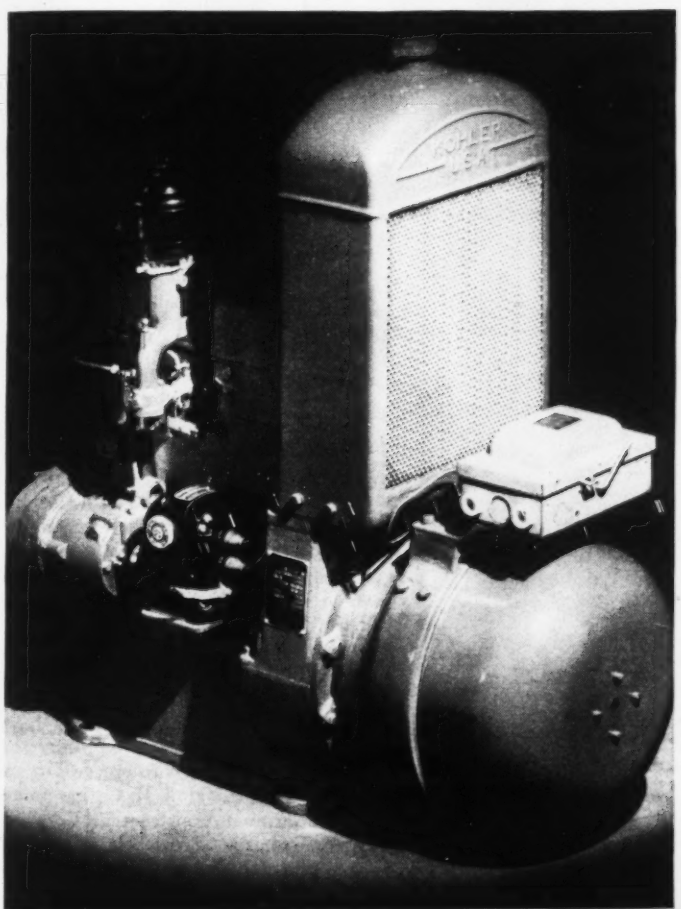
Right: Pennsylvania Turnpike under construction.



Left: In the toll houses of the completed Pennsylvania Turnpike Kohler Electric Plants are installed for stand-by lighting service in case normal power supply fails. Stand-by Kohler Plants also provide important protection for homes, hospitals, farms, schools and other places.

Major American construction jobs use

KOHLER ELECTRIC PLANTS



for auxiliary light and power

During the construction of Pennsylvania Turnpike Kohler Electric Plants were a steady, reliable source of current for flood-lighting night operations and for operating motors, pumps and various tools.

Kohler Electric Plants, during the past quarter century, have served a large number of America's most ambitious construction projects. They have helped contractors and engineers meet schedules on time in the building of roads, bridges, airports, subways, dams, railroads and pipelines.

Kohler Plants are economical to operate, easy to care for and convenient for mounting on cranes, power shovels, draglines and other machinery. Sizes are from 800 watts to 10 KW, AC or DC—with or without metal housing and skid base for portable service. Backed by the 75-year-old Kohler quality tradition. Write for illustrated Folder B-5. Kohler Co., Kohler, Wisconsin. Established 1873.

Kohler Electric Plant Model E, 1500 watts, 115 volt DC.

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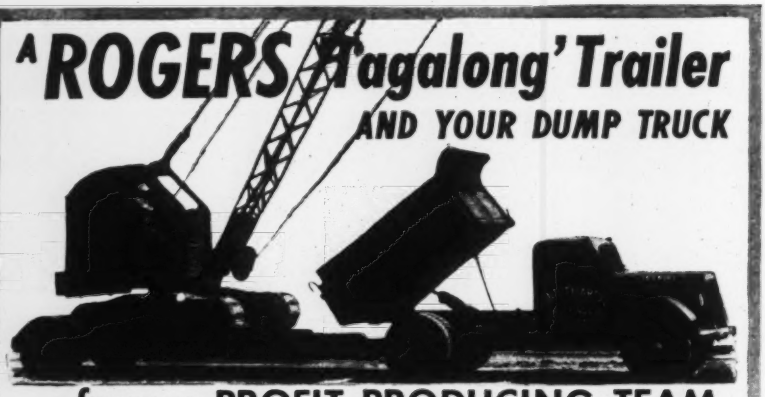


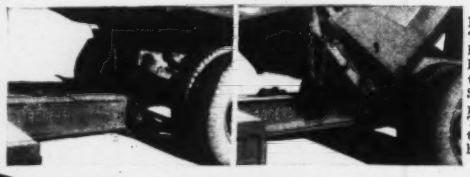
...form a PROFIT-PRODUCING TEAM

Contractors everywhere are turning to the Rogers "Tagalong" for a bigger day's work with maximum economy.

One man can do all jobs. Load and unload trailer, connect and disconnect it; drive truck and operate equipment carried.

Ideal for light and medium shovels, cranes, bulldozers, etc.

Write for complete information.



Showing cable around sheave and dump body about to be raised to engage towing tongue.

Body elevated. Tightened cable has raised drawbar and engaged towing tongue. Safety coupling pin is inserted. Trailer is ready to roll when body is lowered.

ROGERS HEAVY DUTY Gooseneck Trailers

ROGERS BROTHERS CORPORATION

DESIGNERS and BUILDERS of HEAVY DUTY TRAILERS SINCE 1915

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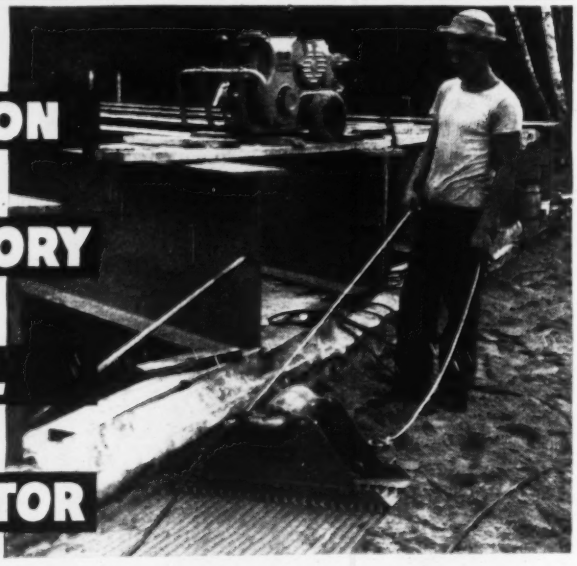

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ELECTRIC TAMPER & EQUIPMENT CO., Ludington, Mich.

Charles Haydock, consulting engineer, Philadelphia, Pa., has been appointed by Governor James H. Duff a member of the State Registration Board for Professional Engineers.

Thomas H. Murphy, Hillsboro, Ohio, Highland County engineer since 1940, has resigned to join the Dayton branch of Bode-Finn Co., Cincinnati, dealers in construction equipment.

G. H. Ferguson, chief of the engineering division of the Canadian Department of National Health and Welfare, is retiring after 27 years service at Atlanta.

James A. Riviere has formed the Jarco Corporation at Orlando, Fla., for general contracting and engineering, including drainage, grading, road work and building. A graduate of Georgia Tech and formerly with the Florida Road Department, Riviere is a veteran of 4½ years in the Navy Engineers Corps. While with the road department, he served four years as division engineer.

R. E. Armstead is supervising the construction of a 3-mile stretch of railroad over which to transport equipment and materials for the construction of a $15,000,000 hydro-electric project on the Dan River in North Carolina for the Duke Power Co. The MacDougald Construction Co. of Atlanta, Ga., has the contract for the railroad.

Leslie B. Allan has been appointed deputy city engineer of Toronto, Ont. He has been a member of the works branch for last 34 years.

Cooper & Perry, engineers and architects have moved to 211 West Hill Ave., Knoxville, Tenn.

Margaret O. Stowe of Randleman, N. C., formerly with the North Carolina State Highway and Public Works Commission, has joined the municipal engineering staff at Greensboro, N. C., as a draftsman. A graduate of the Duke University school of engineering, she is the first woman ever to be employed in an engineering capacity by Greensboro.

John E. Lynch, for the last year building estimator with Byrne Organization in Washington, D. C., has joined the Laburnum Construction Corp., at Richmond, Va. Previously, Mr. Lynch was with the National Housing Agency and before that with the U. S. Maritime Commission. He holds two engineering degrees from Marquette University. During the war he was with the Navy's Seabees in the European and Pacific theaters.

Los Angeles saves tax money *with* 1054 miles *of* CONCRETE STREETS

This 20-year-old concrete on La Brea Avenue north of Wilshire Boulevard is still in excellent condition despite its continued popularity as a route for heavy traffic.

Third Street, a main traffic artery to downtown Los Angeles from the west, was paved with concrete in 1931 and is still good for many more years of economical service.

Typical of concrete economy everywhere

TO state, county and municipal highway officials, all over America, concrete has proved itself the real economy pavement. Los Angeles is a typical example. It has 1054 miles of concrete streets, many of which have been in service for more than 20 years—yet very little tax money has been required for surface maintenance. These streets are still good for many years of economical service.

Hundreds of other communities have had similar experience. The first cost of concrete is usually less than that of other pavements of equal load-carrying capacity. Concrete serves for many years with minimum attention. It has been *proved* to be the real ***low-annual-cost*** pavement. That's why it makes taxpayers' dollars go farther.

Whether you are now planning residential streets, heavy-traffic business streets, or modern expressways, use long-lasting, economical concrete. That's the way to get the most miles of pavement at the lowest cost per year to the taxpayer.

PORTLAND CEMENT ASSOCIATION

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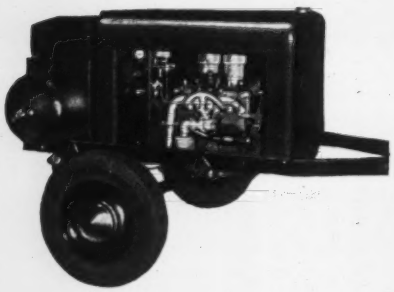
A national organization to improve and extend the uses of portland cement and concrete . . . through scientific research and engineering field work



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READY POWER..portable..economical power, is yours with a lightweight Smith Air Compressor. Big enough to operate medium weight rock drills, paving breakers, clay spades, tampers, large spray guns. Small enough to be towed at truck speeds from job to job. Capacity 60 cu. ft.

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GORDON Smith & CO. Incorporated

430 College St. Bowling Green, Ky.

Elections and Activities

George H. Smeath, Ogden, Utah, Weber County planning director, has been elected a member of the executive board of the Pacific Coast Building Officials' conference.

The Minnesota Federation of Engineering Societies will hold its 26th annual Convention and third annual engineering exposition Feb. 11-14 in St. Paul, Minn. Luncheons, business sessions, dinners and talks by state and national figures have been booked for the convention in Hotel Lowry, while exhibitors are preparing hundreds of the latest engineered products and devices for showing in the municipal auditorium. Katherine A. Feucht, 1000 Guardian Building, St. Paul, Minn., is federation secretary.

M. G. Spangler, Ames, has been elected Iowa section president of the American Society of Civil Engineers. Other officers elected were Paul V. Roberts, Des Moines, vice-president; L. O. Stewart, Ames, secretary-treasurer; J. P. McKean and John Carpenter, both of Ames, directors.

E. M. Stanley, Muscatine, and Joseph W. Howe, Iowa City, have been nominated for 1948 president of the Iowa Engineering Society. The election will be at the society's annual meeting Feb. 17-18 in Des Moines. William P. Nemmers, Des Moines, the 1947 president-elect, will succeed to the presidency at that time. Other nominees named for 1948 offices were Robert S. Casey, Ford Madison, and E. F. Behrens, Des Moines, for vice-president, and T. W. Thorpe and A. F. Faul, both of Des Moines, for treasurer.

G. L. McLane, district engineer, U. S. Public Road Administration, Phoenix, Ariz., is the newly elected president of A. S. C. E., Arizona Section, for the one-year term, succeeding Walter Johannessen. George W. Howard, chief, test section, Engineer Research & Development Laboratories, Yuma Test Branch, Yuma, is vice-president, and Vaud E. Larson, project planning engineer in charge of the Phoenix office, U. S. Bureau of Reclamation, secretary.

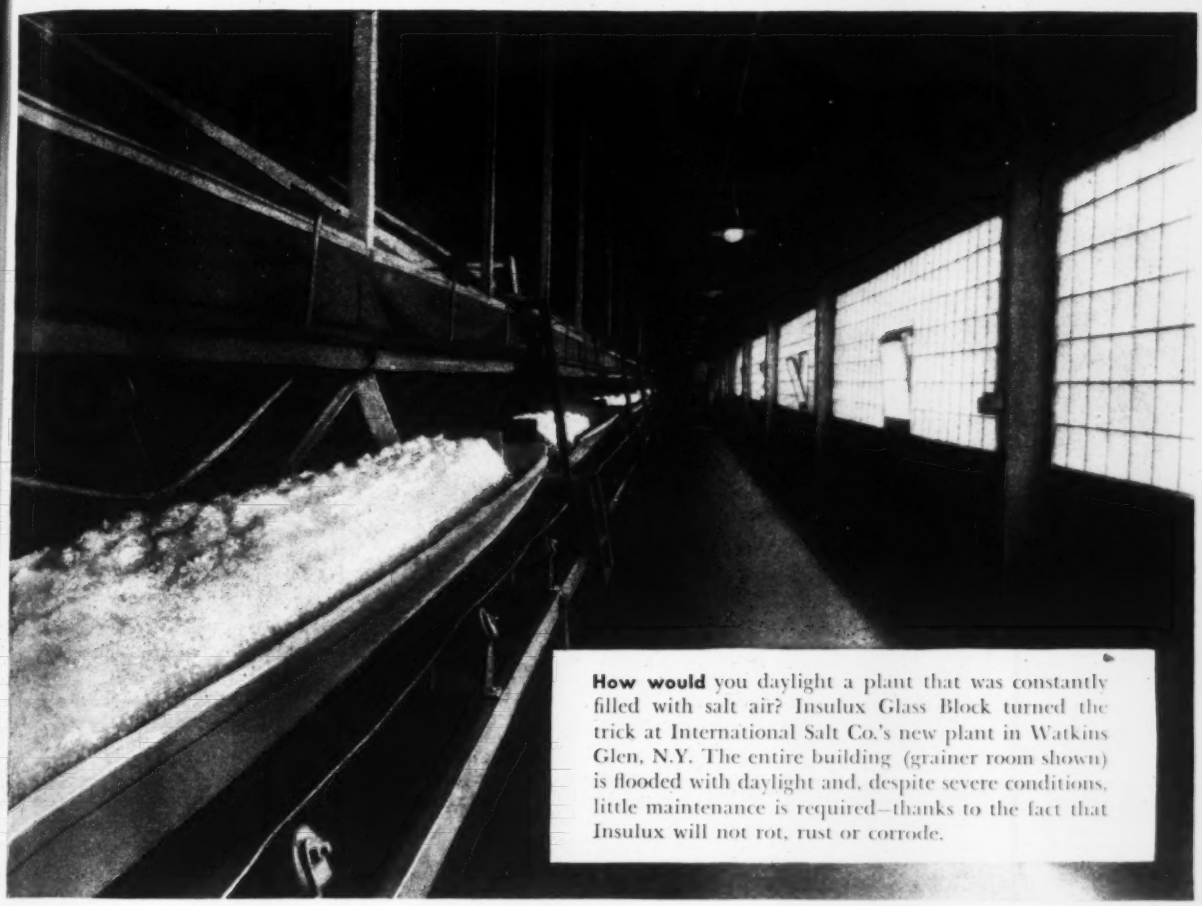
A. F. Mitchell of Corsicana, Tex., has been elected chairman of the Texas State Board of Registration for Professional Engineers. He succeeds J. S. Hudnall of Tyler. Other officers are J. B. Thomas of Fort Worth, vice-chairman, and Carl L. Svensen of Lubbock, secretary. E. W. Pittman of Beaumont and Datus E. Proper of San Antonio are other members of the board.

Connecticut Chapter of the Associated Contractors of America elected the following officers: President, George Johnson, Hartford; vice-president, Edwin Moss, Bridgeport; treasurer, Max Teitelman, New Haven; and secretary, Earl C. Wheeler, Hartford. Elected to the board of directors are: Oscar Stroberg, Waterbury; Thomas Amatruda, New Haven; Philip Epifano, Bridgeport; S. C. Gowrie, Meriden and R. H. Pease, Torrington. Capt. C. F. Grisham, United States Navy, retired, was re-elected executive vice-president.

Raymond A. Williams was elected president of the Professional Engineers Association of Southeast Florida at a recent meeting. Chelsie Senerchia, Miami, was elected first vice-president, and C. K. Lingo, Miami, secretary-treasurer. Other vice-presidents designated are, J. O. Brandla, Hollywood; S. L. Stewart, Coral Gables; E. C. Marino, Key West. Registered engineers and surveyors in Broward, Dade, Monroe and Palm Beach counties compose the membership of the association.

Members of the Georgia Section of the American Society of Civil Engineers have elected the following as officers for 1948. Van Porter Enloe, superintendent of the Atlanta Clayton Sewage Works, president; Professor Thomas H. Evans, head of the department of civil engineering, Georgia School of Technology, vice-president; George A. Belden, Engineer, Central of Georgia Railway, Savannah, Ga., vice-president (non-resident); and Raymond A. Pierce, Engineer, South Atlantic Division, Corps of Engineers, Atlanta, Ga., secretary-treasurer.

John A. Volpe, Winchester, Mass., president of Volpe Construction Co., Malden, has been elected president of the Associated General Contractors of Massachusetts. Mr. Volpe, a charter member of the association, served as its vice-president in 1942 before enlisting in the U. S. Navy. Other officers elected include: Vice President, Thomas Mulcare, Cambridge; secretary, Samuel Suskin, Brookline; and treasurer, William L. Bailey, Melrose. Allen J. Potter and M. Slotnik were elected directors for a period of three years. Mr. Volpe succeeds Allen J. Potter as president.



How would you daylight a plant that was constantly filled with salt air? Insulux Glass Block turned the trick at International Salt Co.'s new plant in Watkins Glen, N.Y. The entire building (grainer room shown) is flooded with daylight and, despite severe conditions, little maintenance is required—thanks to the fact that Insulux will not rot, rust or corrode.

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ECONOMICAL building maintenance in the face of a corrosive atmosphere is a common enough industrial problem.

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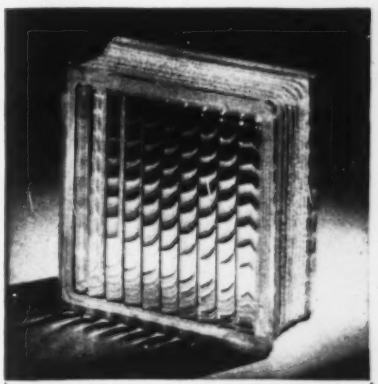
Write today for complete information on the benefits of Insulux Glass Block in new buildings and its use as a modernization material that lowers upkeep. Address Department E-47, American Structural Products Company, P.O. Box 1035, Toledo 1, Ohio.



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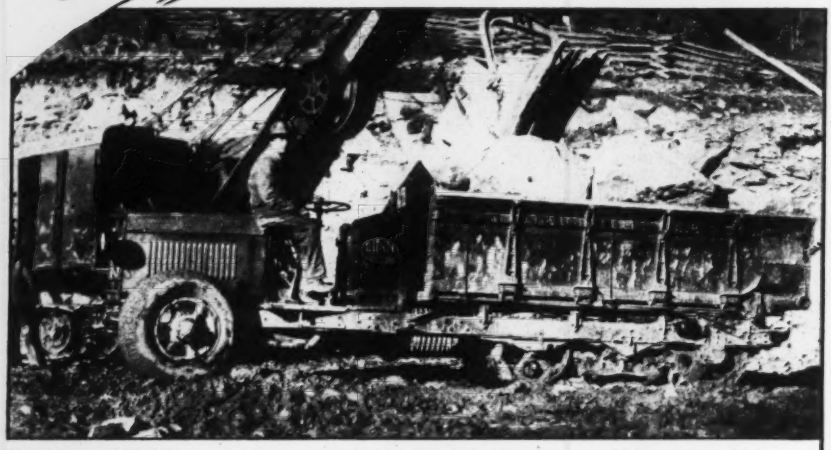

One of several LINNS used on a large project in the Blue Ridge Mountains. Note the reverse driver's seat for high speed reverse driving. Faster spotting, saves time, saves turning, in getting to the dump.

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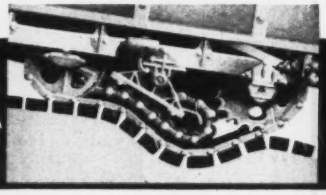
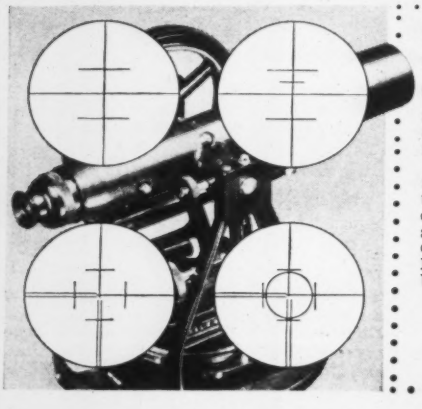


CONTOUR TRACTION



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Manufacturers' Activities

Current developments among manufacturers relating to expansion of services, shifts in personnel, and other changes, include the following:

Home Office Changes—THE DE LAVAL STEAM TURBINE CO., Trenton, N. J., announces that J. P. Stewart has been made manager of the commercial and marine sales divisions, succeeding H. V. Petersen, retired. H. G. Bauer has been made executive engineer . . . Harry Green and Carl Senn are consultants to the FALK CORP., Milwaukee, Wis., on machine shop operations and methods engineering, respectively. . . . J. Robert Pauline is works manager for the Kellogg division of the AMERICAN BRAKE SHOE CO., N. Y. City and J. A. Fellows, assistant chief metallurgist at the Mahwah, N. J. research center . . . R. D. Wood is chairman of the board of the MISSISSIPPI VALLEY STRUCTURAL STEEL CO., Chicago, vice W. M. Wood, retired.

Sales Staff Changes—Boyd Allen is staff manager for customer relations of the JOHNS-MANVILLE BUILDING PRODUCTS DIVISION, N. Y. City . . . H. Merrill Bowman has been made assistant divisional sales manager for power transmission equipment, LINK-BELT CO., Chicago, and E. S. Bogart district sales manager at Baltimore . . . Scott D. Baumer is manager of the technical sales division of the AIR REDUCTION SALES CO., N. Y. City, and E. H. Roper is assistant manager . . . E. George Hartmann has become general sales manager of the JOHN A. ROEBLING'S SONS CO., Trenton, N. J. . . . UNIVERSAL ATLAS CEMENT CO. has appointed Thomas E. Bertelsen sales manager for the Indiana-Michigan district . . . George R. Sommers has been chosen director of sales for all product divisions of SYLVANIA ELECTRIC PRODUCTS, INC., on the Pacific Coast . . . Appointment of E. E. Witt as special representative in construction and industrial sales for CATERPILLAR TRACTOR CO. in the Western division . . . Murray D. Shaffer has been appointed director of sales and research consultant for the BUFFALO SPRINGFIELD ROLLER CO., Springfield, Ohio . . . Frank A. Sweeney has been vice-president in charge of sales of the NATIONAL PORTLAND CEMENT CO., Philadelphia, Pa.

Dealer Appointments — MONARCH ELECTRIC CO., LaSalle, Ill., distributor for full line of HEWITT RUBBER divi-

No place for a weakling!

No need to tell you that when you tackle a tough job, you need tough equipment.

That's why so many construction engineers rely on Monarch Air Hose for heavy-duty air tool or compressor service where hot oil conditions are especially severe. It saves money by reducing costly work delays caused by air hose failures.

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Furthermore, its tough, oil-resisting cover is specially compounded to resist abrasion, as well as impact, oil, weather and sun-checking.

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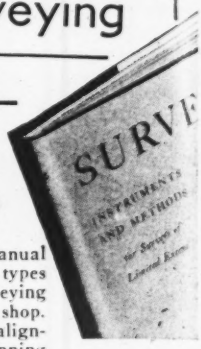
sion's industrial hose, conveyor and transmission belting and packing . . . New distributors for ALL-STATE WELDING ALLOYS CO., INC., White Plains, N. Y., are Lud's Auto Parts, Merced, Calif.; Pompton Welding Works, Pompton Lakes, N. J.; Paul P. Lang, Honey Brook, Pa.; Knoxville Welding Supply Co., Knoxville, Tenn.; and Harris Calorific Equipment Co., Wheeling, W. Va. . . . WORTHINGTON PUMP & MACHINERY CORP., Harrison, N. J., has appointed Henry H. Ritchotte as sales manager in Canada for its construction equipment and mining products . . . POTTS-FARRINGTON CO., Philadelphia, Pa., will handle the Richkraft building papers . . . CHESTER RICE AND ASSOCIATES, Cleveland, Ohio, will represent PLASTELL PRODUCTS CO., Washington, Pa. in several Ohio markets . . . EDWARD VALVES, INC., has appointed CHAS. H. TATE CO. as its Cleveland, Ohio, area representative . . . RALPH B. CARTER CO., Hackensack, N. J., has appointed CLARK-WILCOX CO. of Boston, Mass., exclusive agent for its pumps in the states of Massachusetts, Maine and New Hampshire.

Personalities—J. Thomas Arens has been appointed manager of the U. S. PLYWOOD CORP.'s branch warehouse at Baltimore, Md. . . . W. A. Roberts and W. C. Johnson, executive vice-presidents of ALLIS CHALMERS MFG. CO. have been elected directors . . . H. M. Ridlon has been made assistant director of commercial research for the U. S. STEEL CORP. of Delaware . . . James J. Newman, vice-president of THE B. F. GOODRICH CO. has been elected chairman of the NATIONAL INTER-INDUSTRY HIGHWAY SAFETY COMMITTEE . . . John P. Stevens, Jr., has been elected a director of AMERICAN BRAKE SHOE CO. . . . John Marrow, Jr., vice-president of purchasing and traffic, has retired after 45 years of service with the INTERNATIONAL HARVESTER CO. . . . New officers of the MIDLAND STRUCTURAL STEEL CO. are Charles F. Jarrard, president; William Nemec, secretary-treasurer; and O. C. Robbins, vice-president . . . Kenneth R. MacKinnon has been elected president of EBASCO INTERNATIONAL CORP., N. Y. City . . . John A. Reilly, vice-president, N. Y. and New England area, THE ARUNDEL CORP., has been installed as president of the GENERAL CONTRACTORS ASSOCIATION of NEW YORK . . . SKF INDUSTRIES, INC., has announced these appointments: John H. Tipton as assistant district manager of the Cincinnati office; M. H. Courtenay as assistant district manager of the Atlanta office; and E. A. Hutson as field engineer in the railway sales department of the Chicago office of the company.

NOW

a guide to precision in small-area surveying



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Here is a new manual to help you in all types of small area surveying in the field and shop. Whether you are aligning machinery, planning construction, setting a jig, or making a map, this book will show you the most accurate and rapid methods of surveying the job. The complete subject is covered thoroughly—from the care and use of the instruments and equipment, to practical methods for solving hundreds of specific problems.

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Deceased—Rodney Dennis Hall, 71, N. Y. City, assistant to the vice-president, public works division; WORTHINGTON PUMP AND MACHINERY CORP. at Hartford, Conn., Jan. 13 . . . Lucius Pond Ordway, Sr., 86, St. Paul, Minn., a founder of CRANE CO., at Palm Beach, Fla., Jan. 12 . . . Robert Schoonmaker, founder and president of DIESEL MOTORS CORP., Port Washington, N. Y., Jan. 6.

Miscellany—Robert H. Fox, who has been with SIX WHEELS INC., for seven years, has formed the ROBERT H. FOX CO., Van Nuys, Calif., to specialize in the engineering and sales of special off-the-highway trucks, cranes, shovels and crane carriages . . . CHEVROLET MOTOR division in December produced 110,049 trucks and passenger cars . . . ARMSTRONG BROS. TOOL CO. has new general offices and works at 5200-5300 W. Armstrong Ave., Chicago, Ill. . . . HEWITT-ROBINS, INC., N. Y. City, has organized a new division, ROBINS ENGINEERS, to handle the contracting phase in the design engineering and installation of material handling and processing plants . . . New members in the AMERICAN CONCRETE PIPE ASSN., are Foltz Concrete PipeWorks, Lexington, N. C.; Schmidt Concrete Products, Inc., St. Joseph, Mo; and Lanna Construction Co., Ltd. Prague, Czechoslovakia . . . GENERAL ELECTRIC CO. has announced price reductions affecting a wide range of productions, expected to save consumers about $50,000,000 this year . . . STONE & WEBSTER, INC., has acquired E. B. BADGER & SONS CO. to expand the engineering and construction activities, of its subsidiary, STONE & WEBSTER ENGINEERING CORP. in the process and industrial field . . . Richard H. DeMott, vice-president in charge of sales of SKF INDUSTRIES, INC., Philadelphia, Pa., has been elected vice-president of the EXHIBITORS ADVISORY COUNCIL . . . THE HUBER MFG. CO., Marion, Ohio, is celebrating its 85th anniversary this year. It is also the 40th anniversary of the Huber steam roller . . . Net sales of MARION POWER SHOVEL CO. exceeded $19,500,000 in 1947 . . . Effective Feb. 1, Kellogg division of the AMERICAN BRAKE SHOE CO., maker of air compressors and paint spray equipment, will establish firm prices on all products instead of "price in effect at time of shipment." . . . Chicago has made a contract with the GENERAL ELECTRIC CO. for 7,260 street lights . . . INTERNATIONAL HARVESTER CO. bought principal stock ownership of METROPOLITAN BODY CO. of Bridgeport, Conn. . . . THE MINNEAPOLIS-HONEYWELL REGULATOR CO. has started a "travelling sales convention" that will include visits of company officers to centers throughout the U. S. and Canada.

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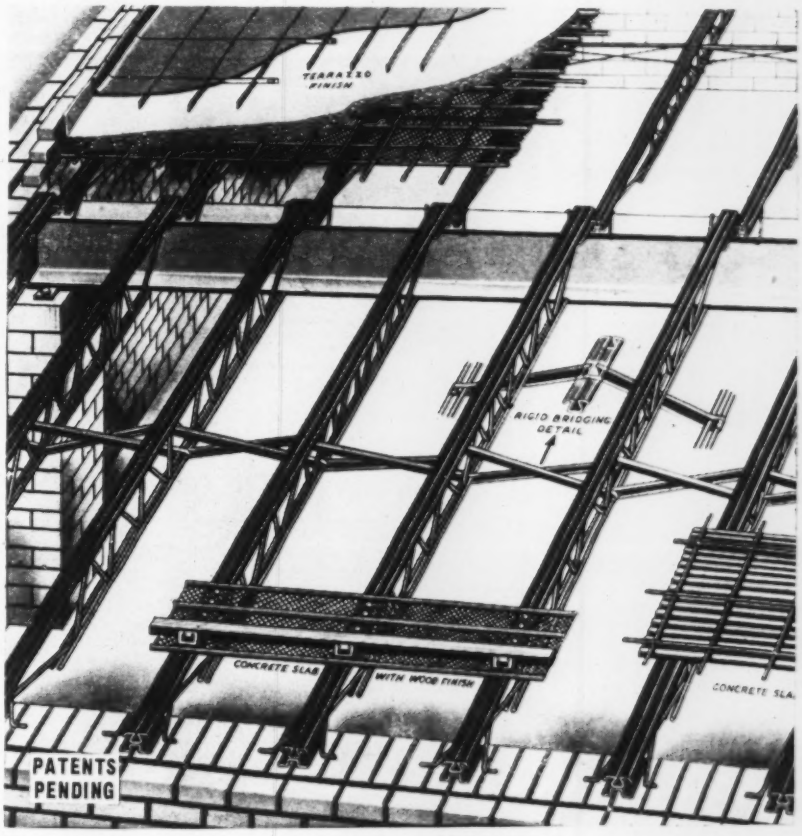

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ELSIE EAVES, Manager J. A. MAHONEY, Reports E. R. BIGGERSTAFF, M. R. ROESSLER, Statistics

WATER SUPPLY

PROPOSED WORK

Colo., Grand Junction—City, treatment plant, over **$100,000**; 15 to 20 mi. water conduit from Grand Mesa to Grand Junction, over **$100,000**; clear water reservoir, over **$100,000**. R. J. Tipton & Assoc., 602 Insurance Bldg., Denver, engrs. and archts.

La., Abbeville—City, plans by Barnard & Burk, Triad Bldg., Baton Rouge, water filteration plant. **$128,000.**

Mo., Moberly—City, Dean Van Ness, mgr., Moberly, raising Sugar Creek Reservoir 10 ft., **$195,000**; enlarging water treatment plant, modernizing filter control sys., addnl. clear well and enlarging size piping to handle higher flow, increasing capacity high service pumping capacity, etc., **$123,000.** Stanley Eng. Co., Muscatine, Ia., consult. engr. CD 5/8/46—ENR 5/30/46.

N. M., Raton—City, bond election this spring, 5 m.g. storage reservoir (concrete and steel as alternates), approx. 10,000 ft. 18 in. equalizing pipe between 3 reservoirs (steel pipe, cast iron or concrete cylinder pipe as alternates). Over **$100,000.** Crocker & Ryan, 408 Mining Exchange Bldg., Denver, Colo., engrs. and archts. CD 6/20/46—ENR 7/11/46.

N. C., Jamestown—Town, water sys. Wm. F. Freeman Engineers, High Point, engrs.

●**Okla., Oklahoma City**—City, addnl. filter plant capacity, watermains, addnl. pump. equip. **$3,495,000.** M. B. Cunningham, city engr.

Pa., Parker City—Parker City Municipal Auth., Parkers Landing, plans by Chester Engineers, 210 E. Parkway, Pittsburgh, filtration plant and waterlines, mixing chamber, sedimentation basin, 2 filters and distr. pumps, intake lines, deep well turbine pumps, 1,200 ft. 6 in. c.i. pipe. **$200,000.**

●**Tex., El Paso**—City, Dan Ponder, mayor, No. 1 addnl. reservoir, **$200,000**; No. 2 addnl. reservoir, **$238,500**; drilling, developing 4 water supply wells, **$200,000**; expan. booster pumping plant, **$43,000**; water treatment plant expan., **$807,900**; addnl. c.i. water lines, **$2,127,100**; renovating WW sys., **$1,162,000.** Ashley Classen, P.O. Box 1349, consult. engr. CD 4/27/44—ENR 5/18/44.

Tex., El Paso—El Paso County Water Control & Imprvt. Dist. 3, L. E. Garrett, pres., bond election soon, water supply sys., drilling and developing wells, **$200,000**; WW sys. except supply, **$450,000.**

Tex., Port Arthur—Jefferson County Water Control & Imprvt. Dist. 6, Fred Hill, clk., Beaumont, water supply wells and pump station, **$75,000**; watermains and distr. sys. imprvs. for 760 acre dist. addn., **$125,000.** Norris & Shipley, Beaumont, consult. engrs.

Va., Charlottesville—City, WW imprvs. **$855,000.**

Ont., Norwood—Village, J. J. Dean, secy., WW sys. About **$100,000.**

Ont., Renfrew—Town, J. R. Barrey, mayor, water filtration plant. About **$200,000.** CD 11/20—ENR 11/27.

SEWERS, WASTE DISPOSAL

PROPOSED WORK

Calif., Roseville—City, sewage disposal plant, **$350,000.** C. E. Meyerdick, city engr. and supt. utilities.

Idaho, Pocatello—City, City Hall, sewerage sys., addns. **$150,000.** L. H. Ballif, Pocatello, city engr. CD 2/13/46—ENR 3/7/46.

N. C., Concord—Town, A. R. Howard, mayor, bond election Mar. 9, sanitary sewers. **$250,000.**

Pa., Erie—City, sanitary sewer in State St. between 19 and Front Sts. **$100,000.** A. N. Aitken, city engr. CD 7/30/46—ENR 8/22/46.

Pa., Kane—Kane Boro, Boro Bldg., sewage disposal sys., 2 complete units for sewage treatment and disposal, **$200,000.** Hill & Hill, North East, consult. engrs. CD 2/7/45—ENR 2/22/45.

Tenn., Chattanooga—City, bond election Mar. 26, sanitary sewer imprvs. **$500,000.** CD 8/27/46—ENR 9/19/46.

●**Tex., El Paso**—City, Dan Ponder, mayor, storm sewer in Franklin St., **$300,000**; storm sewerage sys. in South El Paso, **$1,000,000.** Ashley G. Classen & Assoc., P. O. Box 1349, consult. engrs. CD 10/22—ENR 11/13.

●**Tex., El Paso**—El Paso County Water Control & Imprvt. Dist. 3, c/o L. E. Garrett, pres., bond election soon, storm or drainage sewers, **$500,000**; sewage disposal, **$250,000**; sanitary sewers, **$1,250,000.**

Tex., Port Arthur—Jefferson County Water Control & Imprvt. Dist. 6, Fred Mill, clk., Beaumont, sanitary sewer collection sys. for 760 acre dist. addn. **$150,000**; sewage disposal plant. **$100,000.** Norris & Shipley, Beaumont, consult. engrs. CD 12/9/46—ENR 12/26/46.

†**Wash., Bremerton**—Yards & Docks Annex, Navy Dpt., Arlington, Va., sewage treatment plant at Bremerton Naval Shipyard. **$150,000.**

T. H., Honolulu—City and County of Honolulu, 3,600 ft. 78 in. rein.-con. outfall sewer line, 6,000 ft. interceptor tunnel and subaqueous portion harbor channel crossing about 700 ft. long constructed under 55 ft. water. CD 8/31/45—ENR 9/6/45.

B. C., Kimberley—City, A. D. Cocker, clk., installing sewerage sys. About **$400,000.** CD 12/8—ENR 12/25.

Ont., Toronto—East York Twp., 443 Samman Aves, W. H. Heaton, clk., 15 in. sanitation and necessary storm and storm outlet sewers in O'Connor Dr. from St. Clair, to Yardley Aves. about **$90,690**; 12 to 42 in. storm and 42 in. storm outfall sewers in St. Clair Ave. from Woodbine Ave. to Lot 1, Pl. 3437, about **$61,755.** J. D. Corcorn, c/o owner, engr.

BRIDGES

PROPOSED WORK

Connecticut—State Hy. Dpt., Hartford, railroad underpass, in-l. widening, new approaches Pawcatuck. **$450,000.** G. A. Hill, Hartford, engr.

Kan., Topeka—City, remodeling Melan Bridge across Kaw River, **$200,000.** Finney & Turnipseed, North East Bldg., consult. engrs.

Oklahoma—State Hy. Dpt., Oklahoma City, bridge on farm to market road near Hammon, Roger Mills Co. **$55,800**; bridge at Colcord, Delaware Co. **$67,000.** S. K. McClelland, hy. engr.

Pa., Wilkes-Barre—Comrs. Luzerne Co., Court House, bridge over Conety's Run, Glen Summit, **$60,000**; highway bridge, Duryea, **$60,000.** Robert Williams, co. engr.

Ontario—Province of Ontario, Toronto, bridge over Ottawa River near Airport, Rockcliffe, (Postal Dist. Ottawa) over **$500,000**; bridge over Rideau River near Hurdsman Bridge, (Postal Dist. Ottawa), over **$300,000.**

Ont., Port Credit—Municipality, subway on Centre Rd. **$100,000**; bridge across Credit River on the Lakeshore Rd., **$60,000.**

Ont., Toronto—Municipality, underpass for street cars, at Davenport-Avenue Rd. intersection. Over **$300,000.** M. Stewart, City Hall. engr.

●**Quebec and New Brunswick**—Province of Quebec, Quebec City, and Province of New Brunswick, Fredericton, bridge over Restigonche River to connect Mann, Que. with Campbellton, N. B. **$2,000,000.** Dpt. P. Wks., Quebec City, Que., engr.

STREETS AND ROADS

PROPOSED WORK

Fla., Jacksonville—Comrs. Duval Co., repairs, imprvs. 50 mi. roads damaged by heavy rainfall during past months **$500,000.** A. N. Sollee, Court House, Co. engr.

Neb., McCook—Red Willow Co., graveling 410 mi. county rural mail route roads. **$165,000.**

O., Cleveland—City, City Hall, addnl. 4-lane highway along Shore Dr. between E. 26 St. and Gordon Park, **$400,000**; widening to 78 ft. and resurfacing Clifton Rd. from West Blvd. to W. 117 St., incl. removal street car tracks, **$250,000.**

Oklahoma—State Hy. Dpt., Capitol, Oklahoma City, grading, drainage, asphalt surfacing 5.0 mi. farm-to-market road at Richland, Texas Co., **$51,200**; 11 mi. at Hitchcock, Blaine Co., **$61,000**; grading, drainage, gravel surfacing 7.4 mi. farm-to-market road east of Guymond, Texas Co. **$75,800**; 5 mi. at Hallett, Pawnee Co. **$45,100.** S. K. McClelland, ch. engr.

Pa., Wernersville—Dpt. Property & Supplies, Harrisburg, plans by Baader, Young & Schultze 1500 Walnut St., Phila., State Hospital site grading, roads and walks. **$100,000.**

Tenn., Chattanooga—City, bond election Mar. 26, addnl. street imprvs. **$500,000.** CD 8/16/46—ENR 9/5/46.

Tex., Wills Point—Van Zandt Co., Cant. voted bonds, farm-to-market road in Lit. Dist. 7, 11½ mi. from Wills Point to Neches River, **$90,000**; 16 mi. from Wills Point southwest to border, **$110,000.**

●**Alberta**—Dpt. P. Wks., Edmonton, rebuilding 80 mi. Jasper Hy., from Seba Corner west to Edson. About **$1,500,000.**

EARTHWORK, WATERWAYS

PROPOSED WORK

Minn., Fairmont—Martin Co., H. Christianson, aud., construct County Ditch 49 in Wisterly and Cedar Twps. **$350,000.** A. B. Kless, co. engr.

Tex., Daingerfield—Lone Star Steel Co., Daingerfield, dirt removal, sinking shaft, bracing and walling tunnels for ore mine working **$175,000.**

Tex., El Paso—City, Dan Ponder, mayor, retaining dams, consists 6 addnl. dams Franklin St., enlarging 6 dams. **$300,000.** Ashley G. Classen & Assoc., P. O. Box 1349, consult. engrs.

Tex., Raymondville—Willacy County Red Fish Bay Navigation Dist., Robert Ray, judge, bond election Feb. 14, port imprvs. at Red Fish Bay. **$125,000.** Election Sept. 27 declared illegal. CD 1/16.

AIRPORTS & AIRBASES

PROPOSED WORK

●†**Fla., MacDill Field (Br. Tampa)**—QUARTERS, etc.—U. S. Eng., 575 Riverside Ave., Jacksonville, construct. quarters, control tower, crash station and utilities. **$1,039,380.** CD 11/29/46—ENR 12/12/46.

Kan., Salina—AIRPORT—City, airport **$400,000.** Wilson & Co., Salina, consult. engrs. CD 7/2—ENR 7/24.

●**Md., Baltimore**—AIRPORT TERMINAL—City Aviation Comm.; Robert O. Bonnel, chn. Municipal Bldg., plans by Whitman, Requardt, Greiner Co. & Assoc., B. Everett Beavin, in charge, 11 E. Mt. Royal Ave., 2 and 3 story, 170,000 sq. ft., steel, rein.-con., brick, glass central bldg., 2 wings, incl. stores, offices, baggage rooms, etc. **$3,000,000.** CD 2/7/45—ENR 3/8/45.

Mo., Jefferson City—AIRPORT IMPRVS—City, James T. Blair, Jr., mayor, City Hall, addnl. airport imprvs., incl. grading landing strips, paving 4,100 ft. northwest southeast runway, 100 ft. wide, paving 3,850 ft. east-west landing strip, 100 ft. wide, aprons, taxiways, lighting, storm sewers, water facilities, landscaping, administration bldg., etc. **$673,375.** Black & Veatch Eng. Co., 4706 Broadway, Kansas City, Mo., consult. engr. R. W. Fowler, City Hall, city engr.

Pa., Allentown—AIRPORT—Cities, plans by Joseph F. Bontempo, Baker Bldg., Rochester, airport. **$300,000.** CD 1/14/47—ENR 3/6/47.

●**Tex., Bellaire**—AIRPORT—City, airport imprvs. **$4,500,000.**

Tex., Bryan—AIRPORT—City, defeated bonds, airport Coulter Field. **$100,000.** CD 1/16/46—ENR 2/7/46.

†**Tex., San Antonio**—RECREATION FACILITIES, etc.—U. S. Govt., Lackland Air Base, grandstand or bleachers for baseball, **$40,000**; sports arena, incl. heavy timber type bleacher seats, **$66,000**; playgrounds, incl. 14 new softball diamonds, **$59,000**; earthwork removal in connection with amphitheater development, **$35,000.**

LATIN AMERICA

Bolivia, Cochabamba—Republic of Bolivia, La Paz, plans oil refinery. Over **$500,000.** Yacimientos Petrolifares Fiscales Bolivianos, La Paz, engr.

Brazil, Belam—Companhia Industrial do Brasil, Rua de Municipalidade, 398 Belam, Para, plans plant mfg. rubber products. **$200,000.**

Colombia, Bogota—B. Cement, Ltd., Bogota, plans cement plant addn. and new crushing equip. **$300,000.**

Colombia, Cali—Associated Cement Inc., Cali, plans plant extens. **3,000,000** Pesos.

Mexico, Chihuahua—Mexican Govt., Scrita de Educacion Publica, Mexico, D. F., plans technology institute. **$619,500.**

Mexico, Matamoros—Municipality, plans airport. **$250,000.**

Mexico, Merida—Municipal Govt., Palacio Municipal, Merida, Yuc., Mex., plans slaughterhouse. **$250,000.**

Mexico, Mexico City—C. R. P. Dpt., Lafragua y Ejido, Mexico City, plans 300 homes. **$415,000.**

Mexico, Mexico City—Hormosynth, S. A., Miguel de Cervantes, Saavedra, 5, plans factory. **$300,000.**